THE

ELECTRICAL REVIEW.

VOL. LXX. FEBRUARY 23, 1912. No. 1,787.

ELECTRICAL REVIEW.

Vol. LXX.] CONTENTS: February 23, 1912. [No. 1787.

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THE ELECTRICAL REVIEW.

Published every FRIDAY, Price 4d.

The Oldest Weekly Electrical Paper. Established 1872.

TO BE OBTAINED BY ORDER FROM ANY NEWSAGENT IN TOWN OR COUNTRY.

OFFICE:—4, LUDGATE HILL, LONDON, E.C.

Telegraphic Address: "AGREKAY, LONDON." Code, A B C.

Telephone Nos.: Holborn 933; Central 4425 (Editorial only).

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SUBSCRIPTION RATES.—Per annum, postage inclusive, in Great Britain, 10s. 6d.; Canada, £1 1s. 8d. ($5.30). To all other countries, £1 10s.

BINDING.—Subscribers' numbers bound, including case, for 4s. each volume.

CASES.—Cloth Cases for Binding can be had, price 2s. 6d. each; post free 2s. 9d.

FOREIGN AGENTS.—New York: D. VAN NOSTRAND, 23, Murray Street. TORONTO, ONT.: WM. DAWSON & SONS, LTD., Manning Chambers. Paris: BOYVEAU & CHEVILLET, 22, Rue de la Banque. Berlin: ASHER & Co., Unter den Linden.

Cheques and Postal Orders (on Chief Office, London) to be made payable to Mr. H. ALABASTER, 4, Ludgate Hill, E.C.

THE

UNIVERSAL ELECTRICAL DIRECTORY

(J. A. Berly's).

1912 EDITION READY.

H. ALABASTER, GATEHOUSE & CO.,

4, Ludgate Hill, London, E.C.

EMPLOYERS AND THE INSURANCE ACT.

SEVERAL weeks ago we received from the Secretary to the Employers' Parliamentary Association a copy of a series of questions which that body had addressed to the Chancellor of the Exchequer anent the Insurance Act. We have hitherto refrained from publishing it, in the hope that we might be able to comment upon the answers at the same time, but, alas! although a good opportunity was offered to the author of the Act to make reply, it appears that the questions which nearly affect the employers are among the 498 which remained unanswered at the close of the meeting held last week in the Opera House.

The Association above referred to undoubtedly draws attention to a number of grievances under which the employers will suffer when the Act comes into force. Moreover, as there appears to be a general scramble by various persons and groups of persons affected by the Act to secure amendments or alterations in their favour, the time is not inappropriate for the employer to make his voice heard.

Let us deal with one or two points in regard to which the position of the employer is not always accurately stated on the platform or in the Press. It is said that the employer pays 3d. a week for each man employed, and probably many people consider that this is the limit of his liability. But he has also to pay (through the taxes) his quota of the State contribution; and he has also to defray, out of his own pocket, the cost of collecting the workers' contribution. It will thus be seen that his liability is very considerable.

What is well calculated to upset preconceived notions of fairness, is that the tax so imposed upon him is imposed merely because he is an employer—not because he is a man of substance. Nor does the question of his liability depend upon his success in business. His firm may be paying a dividend of 30 per cent., or it may be earning nothing. In either case, provided the same number of hands is employed, the State insurance premium is the same. Again, a professional man who is earning £5,000 a year may only have to pay insurance contribution for one typewriter, while your manufacturer, who is earning the same income and giving employment to 100 men, must pay £65 a year to the State in hard cash, and must incur other expenses which have been hinted at above.

In the light of these facts, is it to be wondered at that the employer deems himself hardly used and cries out for redress?

But from whence will that redress come? Seeing that the Act is now the law of the land, it is not likely to be modified or varied in the desired sense by the Commissioners. Their duty is to administer it as it stands. But the employer who is refused redress at the hands of the State, must needs take steps to help himself.

That he will take those steps either promptly or by slow

degrees is sufficiently obvious to anyone who is familiar with the conditions of the labour market. Take, for instance, the case of an employer who, owing to lack of work, has had to reduce the amount of employment. At present, rather than dismiss old and well-tried servants, he probably reduces the working hours and keeps all his hands on. What will be the result of legislation which penalises employment? If there are two hands earning half wages, say, 15s., a week each, the employer must pay 6d. to the State; whereas, if he dismisses one outright and pays the other 30s., his liability to the State will be so much less.

It is *apropos* of this difficulty that Sir Charles Macara and his colleagues address to Mr. Lloyd George the pertinent question—"If this is done, will not many more workmen suffer unemployment, and probably require support from the unemployment insurance scheme, or to be maintained from the Poor Rates?"

The comfort extended to the employer who is to bear the brunt of these additional burdens upon industry, is that he will eventually benefit by a general raising of the standard of health throughout the country. It may well be that a rise in the standard of health will enure to the benefit of the employer; but the average man prefers to run his own business in his own way. Moreover, is it quite clear that all the benefits conferred by the Act will operate to the advantage of employers either directly or indirectly? Heaven forfend that we should complain because the Act does something to ease the burden of the unfortunate victim of consumption; but how does the erection of sanatoria help the employer?

In so far as the Act confers benefits of a general kind upon the community, it has much to commend it; but the employers, not unnaturally, protest that a benefit of a general kind should be paid for out of general taxes.

They are under the impression that "the business of employing other people" is being selected as an object of attack, and they bitterly resent it.

We have endeavoured to present this matter from the employers' point of view without any tinge of party bias. Perhaps the hardships we have tried to emphasise may be in some measure redressed by rules and regulations before the Act is actually put into force.

An Electrical Exhibition in the Midlands.

Fifteen municipal electricity committees, two tramway authorities, and one power company, operating in the Midland counties, have resolved upon a combined effort to "boost" electrical applications by means of an exhibition. Birmingham, as an industrial centre in which the variety of scope for electrical application is as great as it is anywhere in the kingdom, is leading the way in this matter, with Mr. Chattock as chairman and Mr. Howard Foulds as secretary of the Exhibition Executive, and Mr. W. E. Milns, also of the Birmingham electricity supply department, as Technical Adviser. The other members of the Executive are:—Messrs. C. E. C. Shawfield, of Wolverhampton; G. Tough, of Coventry; G. R. J. Parkinson, of the Midland Electric Corporation; and J. T. H. Legg, of the Birmingham and Midland Joint Committee. We note with interest, from the prospectus that has been issued, that some of the criticisms offered in respect of last year's electrical exhibition in London have been respected. For instance, "only exhibits likely to promote the employment of the supply of electrical energy by authorised undertakings will be accepted"; the Exhibition will remain open for only three weeks (October 7th to 26th); admission tickets will be issued to exhibitors at 3s. per dozen, only those presented to be charged for; exhibitors may print their own tickets, after approval; first-rate bands will play twice daily; the Exhibition will be extensively advertised throughout the Midland counties; there will be arrangements entered into for railway excursions at reduced rates; and electricity will be obtainable under special contract rate of about 1d. per unit. Taking all these circumstances into account, and it being stated that definite promises of support have already been received from a number of the principal manufacturers, one can only congratulate the Midland counties authorities interested on the prospect of an almost certain success both for electricity suppliers and manufacturers. The Bingley Hall, with its 65,000 sq. ft. of space, is the largest permanent Exhibition Hall in the provinces and it is centrally placed. Particulars of space, charges, and so forth will shortly be available on application to Mr. George Stanley, Winchester House, Victoria Square, Birmingham, who has been appointed Exhibition director and secretary.

Institutions Reforming.

We drew attention in our last issue to the announcement that in future the Institution will hold a summer meeting annually at one of the local centres, so as to bring the provincial members more closely into touch with the main body of their fellows; that this policy will meet with general approval cannot be doubted, and we shall hope to see a very large gathering of the members in June.

In this connection, though it seems a hopeless task, we would again urge the great desirability of providing the members—at least, those who intimate to the authorities that they will be present—with advance copies of the papers, so that the discussions may be the fruit of matured consideration, and not (as such discussions too often are) extempore opinions on surprise packets. In other walks of life—for instance, in the proceedings of Parliament—the members insist upon being afforded due facilities for the preliminary examination of new propositions before committing themselves to the expression of their views. Engineers are rarely practised orators, and are therefore in still greater need of time to prepare their remarks beforehand. The complaint is often made that the Institution discussions are largely monopolised by a certain set of speakers. Is this not in great part due to the fact that many members interested in the papers, and well qualified to discuss them, are deterred from speaking by their natural diffidence, doubting their ability to express their views in orderly fashion without some preparation? Thus the discussion is thrown into the hands of those who are accustomed to public speaking, and are confident of their powers of expression; their opinions may be well worth hearing, but those of the others should not be lost.

The American Society of Civil Engineers, whose procedure, like that of our own Institution of Mechanical Engineers, is in many respects well worthy of imitation, issues the papers for such meetings many months beforehand; our Institution, on the other hand, will not even permit a paper which *has been read* at a local centre to be published, if it is going to be read in London also, until the latter process has taken place. What good end is served by this obtuse policy—this "playing at secrets"? Is it feared that if members knew the contents of a paper in advance, they would absent themselves from the meeting?

Even the ultra-Conservative Civil Engineers are moving in the direction of earlier publicity—they will soon out-run the Electrical Engineers if the latter do not speed up. By a singular coincidence, as we write this a communication has come to hand from the "Civil Engineers' Appointments Board," formed at the instance of the Council of the Institution of Civil Engineers to assist engineers in getting into communication with employers in need of qualified engineering assistants, and *vice versa*. Apparently the operations of this board are not confined to members of the Institution of Civil Engineers. We give further particulars in our "Notes" of the new organisation, whose undertaking, it will be noticed, is intended to be self-supporting.

Copper.

The statistics relating to copper during 1911 have been compiled so as to form the basis of an able and exhaustive article appearing in the number of the Chicago *Mining and Engineering World* for January 27th. The world's output for the year is given as 886,640 (English) tons, of which the United States produced over one-half, Mexico, Spain, Portugal and Japan about $\frac{1}{20}$th each, and Australasia nearly as much, followed by Chile, and Peru, Russia, Germany and Canada, the last four nearly equal, with 25,700 to 27,000 tons. The percentage output of the United States to the whole production for 30 years is given in another table, from which we note that this was at its lowest (so far as recorded) in 1880, when it was 16·2, and at its highest in 1906, when it was 58·1. For 1910 it was 54·2, and for 1911, 54·8. The curtailment agreement, says the writer, first entered into in 1910, was supposedly for only a period of a few months, but from developments during the past year it appears the agreement was subject to an extension.

The productions of the various States are lead by Arizona, followed closely by Montana and Michigan, and then by Utah, with about half the production of the first-named. The production by months shows a decided decrease only for August and September, occurring again in November and December, but apparently depending more on trade circumstances than concerted action. The total deliveries give an idea of the state of trade. These were highest in December, and lowest in January. Stocks were highest in June and lowest in December. The domestic consumption rises fairly well throughout the year, as also does export, while production, which averages 119,300,000 lb., is at its highest, at 130 million lb. in March, and lowest, at 109 million, in February. Imports of copper (including old copper) into United States are given at 108,000 tons, and would appear to fully equal (if not exceed) those for 1910. Prices have been flat, only showing a tendency to rise at the end of the year.

Among the opinions quoted on the position is that of Mr. James McLean, Vice-President of Phelps, Dodge & Co. According to his figures, the world's production has increased 73 per cent. since 1900, but consumption has increased 77 per cent. Together with other experts, he infers that the limit of production (until new fields are opened up) is in sight, but consumption may still go up.

The production for January given by the United States Copper Producers' Association is 58,270 tons, a decrease of 1,544 tons from December. The deliveries to domestic consumers have decreased by about the same amount. The deliveries for export have, however, largely increased. Naturally the stocks have borne the remainder of the consumption.

Electrical Engineer Wanted.

The Trim Board of Guardians do not appear yet to have heard of the Rules of the Association of Consulting Engineers, if we may judge by an advertisement which appeared in the *Leinster Leader* of the 17th inst. In this advertisement tenders are called for from engineers who are prepared to undertake the duty of supervising "the work of providing and fitting up an electric lighting and motor installation at Trim Workhouse." With their tenders applicants must send certificates as to their fitness for carrying out the duties, and they must be in attendance at the meeting of Guardians at the hour of noon on March 2nd.

We do not suppose there will be a rush of professional gentlemen from Victoria Street to Trim in order to secure this competitive appointment, and we are really glad to think that no self-respecting consulting engineer will even consider applying for the post. At the same time, there is something to be thankful for in the fact that the Trim Guardians recognise that it is to their interests to employ an expert to advise them, and we cannot blame them for taking the only course known to them in order to secure the technical assistance they need.

ELECTRICAL DEVELOPMENTS IN STRATFORD-ON-AVON.

Electricity supply was commenced by the Stratford-on-Avon Electricity Co. in April, 1907. In the first place, it was hoped that water power could be utilised at the Alverston Mill site, but a closer examination of the circumstances of the case showed that the power available would not justify the capital outlay involved. The possibilities of a Diesel oil-engine installation, on the present site in Arden Street, were then considered, but the capital outlay required would have been heavy, and there was great uncertainty as to the future trend of the oil market.

Under these circumstances, Mr. C. D. Falcke (then, as now, chief engineer to the company), recommended the adoption of suction-gas plant, and the original installation comprised one 50-B.H.P., and one 81-B.H.P. Hornsby-Stockport suction-gas engine fed from Mersey producers and direct coupled to Johnson & Phillips interpole dynamos.

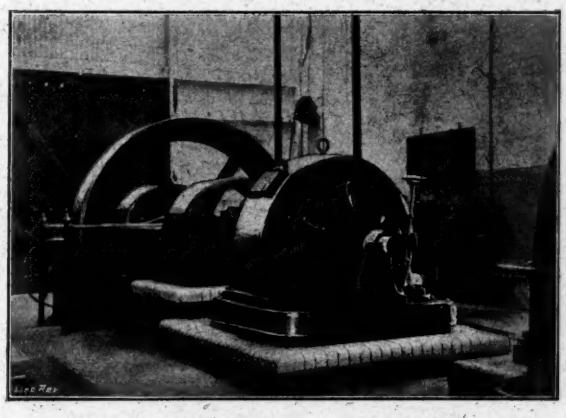


Fig. 1.—New Gas Engine and Generator, Stratford-on-Avon.

The rapid extensions in the load supplied by the station (see Table I) soon called for additional plant, and in July, 1910, a third unit (see fig. 1), was installed, comprising a 170-B.H.P. National suction-gas producer, and a two-cylinder engine direct coupled to an 85-KW. Bruce Peebles dynamo. The accommodation of this engine and generator required but a slight elongation of the original power house,

TABLE I.

Statement of Electricity Generated, Sold, &c.

Year.	Units generated.	Units sold.	Per cent. sales.			Per cent. generated.		Max. load. KW.	Average d./B.T.U.
			Lighting.	Power.	Heating.	Used in works.	Unaccid.		
1908	71,340	43,551	40·0	53·6	6·4	28·2	10·8	76	3·03
1909	102,845	77,055	43·4	51·5	5·1	18·8	6·4	75	3·04
1910	128,011	98,289	44·6	45·9	9·5	17·7	5·6	87	3·13

and there is still sufficient room on the building site to carry the end wall, shown in fig. 1, outwards to make room for two 100 or 150-KW. sets. That further extensions will soon be required cannot be doubted, there being already insufficient space capacity to allow for breakdown contingencies during the winter peak.

The original switchboard has been enlarged by two panels and now includes: three-generator panels, battery-booster motor and dynamo panels, balancer panel, feeder panel and end-cell panel.

The 300 ampere-hour "D.P." battery is still in use, and has not yet been extended. Its performance has given every satisfaction, and on the occasion of our visit, the cells were undergoing their first cleaning. About $1\frac{1}{4}$ in. of "sludge" had collected during the past four years, and this was being removed by hand (after siphoning out the acid), pumping being found an unsatisfactory means of removal. The maximum discharge current usually demanded from the cells is 50-60 amperes, and, in the light of recent experience, it would

have been preferable to have installed a larger battery in the first instance, so as to enable an earlier shut-down of the station (which is now run in two shifts, from 4.30 a.m. to 2 p.m., and from 2 p.m. to 11.30 p.m., or midnight), and heavier daily discharge of the cells. The battery booster has proved of insufficient capacity, hence end cells have lately been adopted for regulating purposes.

The railway coal rate from Swansea to Stratford being 7s. 2d. per ton, high grade anthracite cannot be obtained in the latter town at less than 26s. per ton, which rate was paid till July, 1910. On installing the new 170-H.P. set,

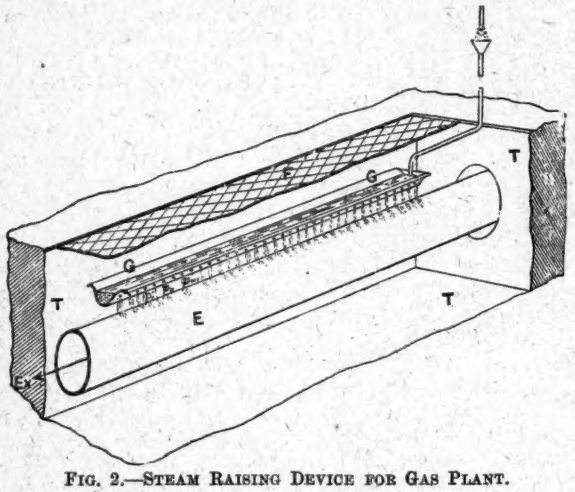


Fig. 2.—Steam Raising Device for Gas Plant.

trial was made of anthracite "slack" fuel (17s. per ton grade), in the producers. As had been feared, the poorer fuel caked badly and the standard steam raising attachments on the producers failed to supply sufficient steam to maintain a cool fire (particularly on heavy loads).

Before reverting to the dearer fuel and its consequent handicap on the profits of the station, Messrs. Falcke and Spiers devised a novel system of steam raising which has since given the utmost satisfaction and which, by reason of its simplicity and efficacy, deserves detailed notice.

As indicated in the diagrammatic sketch, fig. 2, water is run into a length of gutter troughing G, whence it trickles through side perforations* p_1 p_{11}, p_{111} on to the exhaust pipe E, between the engine cylinder and the silencer. G and E are located in a trough T (covered by a floor plate F), whence steam is automatically drawn to the base of the gas generator P, fig. 3, by the suction of the engine admission stroke. To give an approximate idea of the amount of water vaporised, the 81-B.H.P. set, carrying 30-KW. load, required a stream of water about $\frac{1}{8}$ in. diameter (about 20 ft. head) to be run into G (fig. 2).

No device could be simpler, and experience has shown that each engine can thus provide the full steam required by its own gas generator. By connecting tunnels and dampers, any engine can be supplied wholly or partially by any producer, and the latter can be fed with steam from any exhaust pipe.

Whereas fire bars burned out in from one to two weeks when using anthracite slack in conjunction with the standard vaporisers fitted to the producers, a life of from four to six months is obtained under the new system of working. Moreover, the steam supply is now strictly proportioned to the load, and a uniform quality of gas is maintained under all circumstances, together with a cool, clean-burning fire in the producers.

As the result of the adoption of the above system, the coal costs at Stratford, which averaged 0·40d. per unit sold in 1910, fell to 0·35d. per unit during the first six months of 1911, and were expected to reach 0·32 to 0·33d. per unit during the last half year. The total sales in 1910 were 98,289 units, and during 1911 it was hoped to exceed this figure by at least 20,000 units, while incurring a lower total coal bill.

A 3-H.P. D.C. motor in the repair shop drives the lathe of the latter and drilling machine, and, in addition, a small fan blower, used to start up the first producer after a period of shut-down. The remaining producers are started as required by gradually opening their delivery valves. The delivery pipes being in parallel, the suction of the running engine rapidly brings the additional producers to working heat.

In the original installation, provision was made for starting up the engines by petrol, but the well-known liability to preignition on this system, and the dangerous mechanical shock thereby thrown on the cylinder and moving parts, have led to the installation of a compressed-air starting equipment driven by the electric motor shown on the wall bracket in fig. 1. The 170-H.P. set is now easily started and brought to full-load output in five minutes.

The old (smaller) engines are single-cylinder machines with "hit-and-miss" governing, but the new unit has two cylinders, four engine bearings, and is governed by graduated admission (controlled by a floating striking plate engaging at various points on a tapered block). The 81-H.P. engine has a 4-ton fly-wheel, whereas that on the 170-H.P. set weighs but 6 tons, yet vibration and cyclic speed variation are very slight.

It should be noted that in the new generating set 2 B.H.P. have been allowed per 1 KW. electrical output. This liberal allowance of engine capacity is necessary to ensure satisfactory peak performance with suction-gas plant. The 85-KW. dynamo specification included not more than 75° F. temperature rise during 8 hours' full-load run, followed immediately by 2 hours' run at 20 per cent. overload; actually, the temperature rise under these conditions does not exceed 70° F.

The gas cleaning towers on the various producers are very effective, and the engine valves need grinding once in from four to eight weeks, according to load. Until recently, the exhaust valve-rod guides were unlubricated, with the result that the valve stems wore badly during the first month of their life. Though subsequent deterioration was much slower, there was sufficient leakage round the worn stem to cause an unpleasant smell. This trouble has now been overcome by lubricating the guides with high-temperature grease (melting at 400° F.), fed from stuffing boxes with tell-tale plungers.

The valves are now turned up from forgings by the company's staff, a rather thicker stem being adopted than is

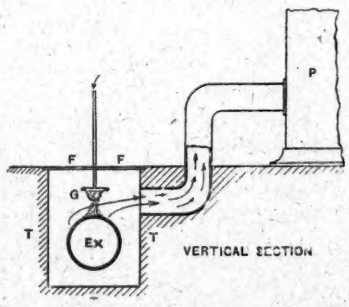


Fig. 3.—Steam Raising Device and Producer Connections.

provided by the engine makers, and a boss being left immediately below the valve head to allow for the local pitting which occurs at this point, and which first demands the renewal of the fitting.

Producer linings are found to last between two and three years, and are scraped about once per month. The fires are "sliced" as often as may be necessary, there being no risk of explosions within the generators when working under the new system of steam raising. Ashes from the producers are carefully sifted and the small pile of fuel refuse resulting from one year's working was, by its insignificant amount and worthless quality, a striking testimony to the economical working of the station.

Water for cylinder cooling and steam raising is pumped from a surface-water well by a $\frac{1}{2}$-H.P. motor driving a single-acting pump delivering 300 gallons per hour to an overhead tank, whence supply is by gravitation. The water supply,

* The advantages of *side* perforations, as opposed to perforations along the bottom of the troughing, include steadier flow from the former and non-clogging of the perforations by solid matter, which is now deposited at the bottom of the trough.

which is exceptionally hard, and which rapidly furred up the original producer vaporisers, but which has no injurious effect with the new system of working, reaches 2,000 gallons per day in winter, and is then run to waste after use; in summer, however, the outflowing water is returned to the well, through a coke filter bed, for re-use.

So far, there has been no evidence of the abnormally high repair charges usually instinctively associated with gas-engine plant; nor is there any reason to expect any such extraordinary expense in future. The cleanliness of the station leaves nothing to be desired, and there is an entire absence of nuisance by vibration, noise or fumes.

For so small an undertaking, the Stratford-on-Avon Electricity Co. is already fortunate in possessing a well distributed load and several very valuable power consumers. The average load during the day is about 30 KW., while the winter peak reaches 90 KW. During the summer months, two essentially off-peak power consumers are a brewery taking 20 H.P. for a refrigerating plant from 5 a.m. to 6 or 7 p.m. daily from April to September, and a mill having a 60-H.P. motor, averaging 40 H.P. output between 6 a.m. and 8 p.m. daily from July to September.

The 25-KW. and 50-KW. generating sets are found very convenient for supplying the day load, and are therefore likely to be retained for some time to come. The new generator which will shortly be required, will be of 100—120 KW. output.

Stratford is essentially a conservative town (though considerable residential developments appear imminent), and in securing 200 consumers and an annual output of 100,000 units after four years' working, the Electricity Co. has attained no mean achievement—particularly when it is remembered that gas supply is in the hands of the town authorities, who therefore carry out the street lighting with incandescent gas. An excellent heating load has been secured, and the total motor load now exceeds 120 KW. An electricity showroom is soon to be opened in one of the main streets, and a vigorous system of circularising present and prospective consumers concerning the economy and merits of various electrical apparatus, is already in force.

Mr. Falcke has wisely advocated moderate prices throughout, and has actually been able materially to reduce the favourable tariffs inaugurated in 1907, in certain cases. Lighting supply is still at 5d. per unit, but heating and cooking demands are supplied at 1½d. per unit, while for power purposes the charges are from 2½d. to 1½d. On the testimony of numerous consumers, the lighting supply at 5d. per unit is, with a mixed metal and carbon-lamp equipment, equivalent to, or cheaper than, gas at 2s. 7d. per 1,000 cb. ft.

The Stratford undertaking, having grown up with the development of the metallic-filament lamp, has experienced no set-back from the latter. Among the more interesting consumers, other than the special power demands above noted, are:—

1. *The Stratford Hospital.*—Now lighted entirely by metallic-filament lamps, and which showed a material saving on its lighting bill during the first year after its conversion from incandescent gas lighting. This result had naturally great weight with residents in the locality.

2. *Holy Trinity Church.*—Employing a Kinetic organ blower driven by a 7-H.P. electric motor in place of the old hydraulic equipment. Electric fans are now being installed to circulate warm air through the church from a central slow combustion stove. A very elaborate metallic-filament lighting scheme was recently installed; unfortunately, the effect was considered too "theatrical" by certain church dignitaries, and the equipment was therefore replaced by a simple arrangement of half-frosted bracket lamps supplemented by short lengths of tubolite in the vestry and choir stalls.

3. *Shakespeare Theatre.*—During its spring and summer sessions (each lasting about one month), the theatre affords a very acceptable load. The demand is naturally irregular, but is worth about £60 per annum to the station.

The total length of house supply feeders approximates 10 miles, and armoured, lead-sheathed cables laid direct in the ground are now used in preference to the bitumen-filled wooden cable troughs originally employed; the cost of the former is considerably lower. To the best residential district, duplicate feeders are laid to avoid the risk of cessation of supply due to cable breakdowns.

For shop lighting, a comparatively small number of Verity miniature arcs and a few of other makes are employed, but for this purpose and for ordinary domestic lighting, the use of metallic-filament lamps is rapidly extending.

In concluding this brief description of a very interesting undertaking, we wish to express our appreciation of the courteous assistance rendered by Mr. C. D. Falcke and his assistant, Mr. P. Spiers.

ELECTRICAL LAW IN THE BRITISH DOMINIONS.

[FROM OUR LEGAL CONTRIBUTOR.]

(*Continued from page* 245.)

2. *Queensland.*—The list of statutes in force in Queensland only contains a reference to one Act relating to the supply of electricity for light and power. We refer to an Act "to facilitate and regulate the supply of electricity for lighting and for other purposes" (1896), 60 V., No. 24. Prior to this date, it appears that the supply of electricity was only regulated, if at all, by one or two private Acts.

The Act of 1896, which appears to be modelled upon the English Electric Lighting Acts, is divided into parts as follows: (1) Preliminary; (2) Constitution of Electric Authorities; (3) Powers, Duties and Obligations of Electric Authorities; (4) Protection of Government Telegraph Lines; (5) Supply of Electricity and Recovery of Charges; (6) Purchase of Undertaking by Local Authorities; (7) Regulations and By-Laws; (8) Offences; (9) General Provisions.

The term "electric authority," as used in the Act, signifies any local authority, company or person, authorised by an order granted under the Act, to supply electricity within any prescribed area.

1. Preliminary: Sec. 4 embodies the principle that electricity must only be supplied by the State. It provides that, "From and after the passing of this Act, and subject only to the provisions in this part of this Act hereinafter contained, no local authority, company, or person shall construct or use any electric lines or works, or supply electricity, except under the authority of an order pursuant to this Act.

Provided that this Act shall not apply in any case in which an electric line is not constructed or used, or electricity is not transmitted or supplied beyond the limits of the buildings or premises in which the electricity is generated. This section has the effect of prohibiting the supply of a private company or person to a few neighbours. Sec. 6, however, makes an exception in the case of persons or companies which, at the passing of this Act, were supplying electricity.

2. Constitution of Electric Authorities.—Just as the Board of Trade has power to grant a provisional order for the supply of electricity in England, the Governor of Queensland in Council, may, by Sec. 8 of the Act under discussion, "From time to time by order in Council authorise any local authority, company, or person to supply electricity within any prescribed area for such purposes as may be specified in the order, and for such period subject to the provision of part 6 of this Act, as the Governor in Council may think proper."

Sec. 10 embodies the principle laid down by Sec. 4 of the Electric Lighting Act, 1882, and Sec. 1 of the Electric Lighting Act, 1888, by which the local authority is entitled to notice of the intention of a private company to apply for an order. It is to be observed that although such an order is not to be granted except with the consent of the local authority, the Governor in Council may, in a proper case, dispense with such consent. Sec. 2 provides that the electric authority shall be subject to such conditions, limitations, and liabilities as may be inserted in, or prescribed by, the

order affecting the undertaking with regard to a number of matters. To put it generally, the supply is subject to restrictions similar to those which are laid down in the Schedule to the Electric Lighting (Clauses) Act, 1899.

3. Powers, Duties, and Obligations of Electric Authorities; and 4, Protection of Government Telegraph Lines.—These are practically identical with the corresponding provisions of the English Acts.

5. Supply of Electricity and Recovery of Charges.—This part makes it incumbent upon an electric authority to supply electricity, and prohibits it from prescribing any special form of lamp, or making any undue preference to any consumer.

6. Compulsory Purchase.—The provisions of the Act relating to compulsory purchase are identical with those contained in the Electric Lighting Act, 1888, Sec. 2.

7. Regulations and By-Laws.—These are made by the Governor in Council.

Amongst the General Provisions (9), Sec. 58, provides that whereon matters in the Act are directed to be decided by arbitration, the arbitrator is to be nominated by the Governor in Council on the application of either party.

3. *Victoria.*—The supply of electricity in Victoria is regulated by the Electric Light and Power Act (No. 1,413), of 1896, as amended by the Electric Light and Power Act (No. 1,694), of 1900. These statutes bear a strong resemblance to those of Queensland, which have already been referred to. They are obviously founded upon the English Electric Lighting Acts.

Sec. 5 of the Act of 1895 provides that :—"No Council (*i.e.*, no Council of any municipal district), company, or person, shall use, lay, erect, construct, or put up, or place, any electric line, or supply electricity for public purposes, or private purposes, except under the authority of an Order made pursuant to this Act." This provision is subject to a proviso in favour of those who were supplying electricity at the time when the Act came into operation.

By Sec. 10 it is provided that subject to the Act the Governor in Council may, from time to time, by order authorise any Council to supply electricity for any public or private purpose within any area, and in the case of any company or person for such period not exceeding 30 years, as the Governor in Council may think proper.

The Act contains the usual provisions for notification to the local authority of any application to be made by a company or person. The consent of the local authority is generally required, but the Governor in Council has power to dispense with such consent in a proper case.

The provisions of the English Electric Lighting Acts with regard to the breaking up of, and interference with, highways and the interference with wires, &c., under the control of the Postmaster-General, seems to have been adopted *in toto* by the Victorian Legislature.

By Sec. 43 a right of compulsory purchase is conferred upon Municipal Councils.

The terms and conditions upon which this right may be exercised are practically identical with those which are to be found in Sec. 2 of the Electric Lighting Act, 1888. It is to be noticed, however, that the right may be exercised after 30 years, "or shorter period as is specified in that behalf in the order from the date of the order." The value of the lands, buildings, materials, plant, and works shall be deemed to be their fair market value at the time of the purchase, due regard being had tc the nature and then condition of such buildings, materials, plant, and works, and the state of repair thereof, and to the suitability of the same to the purposes of the undertaking, but without any addition in respect of compulsory purchase or of goodwill or of any profits which may have been, or may be made, from the undertaking or of any similar considerations.

By Sec. 44 the Governor in Council has power to vary the terms upon which any Council may require the undertakers to sell.

Sec. 25 puts a limitation upon the profits which may be distributed. It provides: "The profits which may be divided amongst the shareholders of any company being an undertaker under this Act, so far only as such profits are derived from supplying electricity shall not in any year exceed £10 per cent. on so much of the paid-up capital of such company as has been apportioned for the works or expenditure of such company as an undertaking under this Act. Provided that whenever throughout any half-year any company shall charge for electricity supplied a less price than the maximum charge fixed by order authorising the undertaking, such company may increase such rate of dividend for such half-year by ½ per cent. on the paid-up capital for each and every reduction of ¼d. per unit in the price of electricity."

A later Act (The Electric Light and Power Act, 1901, No. 1,775) provides that no Council of any municipal district shall transfer any legal powers given to them by the principal Act (*i.e.*, the Act above-mentioned) or give its consent to the grant of any order unless a poll of the ratepayers has been taken to ascertain their views. The Act also contains provision for the taking of such poll. This Act also provides (by Sec. 3) that no electricity undertakers or gas company may charge for the supply of electricity or gas used for power or heating purposes respectively or both a lower uniform charge than that charged for the supply of electricity or gas used for lighting purposes.

4. *South Australia.*—Legislation relating to the supply of electricity in South Australia seems to be confined to an Act which was passed in 1891 "to authorise municipal corporations and district councils to supply gas and electricity for lighting and other purposes." This statute is No. 531 of 1891. Part II is devoted to the supply of electricity, but many of the provisions of Part I which relate to the supply of gas, are made applicable to electricity by making the word "gas" include "electricity," and the word "pipe" include "electric line."

Sec. 49 provides that—"Any local authority may, subject to the provisions of this Act, supply electricity for any public or private purposes, within the limits of its district, or within such other limits as the Governor may from time to time by proclamation in the Government gazette, allow, provided that where such other limits comprise land within the district, of any other local authority, such proclamation shall not be made without the consent under seal of such other local authority."

In supplying electricity the local authority shall be subject to such regulations as may from time to time be presented by the Governor by Proclamation in the Government gazette with regard to the following matters :—

(*a*) The limits within which, and the conditions under which, a supply of electricity is to be compulsory or permissive.

(*b*) Securing a regular and efficient supply of electricity.

(*c*) Securing the safety of the public from personal injury, or from fire, or otherwise.

(*d*) The limitations of the price to be charged in respect of the supply of electricity.

(*e*) Authorising inspection and inquiry from time to time by the governor and any local authority which shall be concerned, other than the local authority supplying the electricity.

(*f*) The enforcement of the due performance of the duties of the local authority in relation to the supply of electricity by the imposition of penalties and otherwise ; and

(*g*) Generally with regard to any other matters in connection with the supply of electricity.

Note.—The power here conferred upon the governor is very similar to the power to make rules which is vested in the English Board of Trade.

By Sec. 51 the local authority within any part of whose district the electricity is, under proclamation, authorised to be supplied by any other local authority may, in addition to any regulations which may be made under the provisions of the last preceding section, for securing the safety of the public, from time to time make, rescind, alter, or repeal by-laws for further securing such safety, and there may be annexed to any breach of such by-laws such penalties as the local authority think necessary, not exceeding £50 for each offence, provided that no such by-law shall have any force or effect unless and until they have been confirmed by the governor, and published in such manner as the governor may direct.

For the rest it may be taken that this Act follows the broad lines of the English Electric Lighting Acts.

5. *Western Australia.*—In 1892 an Act was passed in Western Australia entitled "An Act to authorise municipal

Corporations to supply or to grant licences or make contracts for the supply of electricity for lighting and other purposes." This Act was amended by the Electric Lighting Act Amendment Act, No. 7 of 1905, and as so amended it provides (by Sec. 1) that any local authority may, subject to the provisions of the Act, supply, or from time to lime, licence or contract with, any company or person to supply electricity for all or any of the purposes mentioned in this Act within the limits of the municipality, or within such limits as the governor may, from time to time by proclamation, approve and allow. The term local authority as used in this section means the Council of a municipality or the board of a road district Council.

A licence or contract so granted may be for any period, or periods, not exceeding 21 years, and shall be subject to such regulations and conditions as to the performance by any such company or person of their duties in regard to such supply for the revocation or rescission of the licence or contract where the said company or person shall fail to perform such duties to the satisfaction of the local authority for authorising inspection and inquiry from time to time by any officer of the local authority, and generally with regard to any other matters in connection with any such licence or contract or supply of electricity.

In cases where the local authority exercise their right of entering into a contract under the Act, they have power to introduce terms of purchase, &c.

By Sec. 7 undertakers are also made subject to such regulations and conditions as may from time to time be prescribed by the Governor and published in the *Gazette* with regard to the following matters :—

(*a*) The limits within which, and the conditions under which, a supply of electricity is to be compulsory or permissive.

(*b*) Securing a regular and efficient supply of electricity.

(*c*) Securing the safety of the public from personal injury or from fire, or otherwise.

(*d*) The limitation of the prices to be charged in respect of the supply of electricity and the rent and sale of meters and fittings.

(*e*) Authorising inspection and inquiry from time to time by the Governor.

(*f*) The enforcement of the due performance of the duties of the undertakers in relation to the supply of electricity by the imposition of penalties or otherwise ; and

(*g*) Generally with regard to any other matters in connection with the supply of electricity.

It will be seen that rules may be framed under this Order, which would take the place of our own Board of Trade Regulations.

(To be continued.)

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

Professional Opening for Talent.

Unfortunately, at the time of writing I have not had an opportunity of reading a full report of Mr. Hugo Hirst's speech at the annual dinner of the G.E.C., briefly reported in the daily papers. It appears, however, that Mr. Hirst, whilst crying up his staff recruited from the office boys, is bewailing the fact that he is unable to obtain the services of public school men of social standing for some of the highly-paid positions his firm is able to offer.

The positions to which Mr. Hirst would appear to refer are those of commercial engineers, as he mentions that it is usual to ask a premium of £300 or more from such men for their training, whilst at the same time talking of the commercial side—I fail, however, to see how any office boy can fulfil the technical qualifications for such a post, however good a commercial man he may become.

Now, I would like to know how many appointments the G.E.C. have advertised in the ELECTRICAL REVIEW during, say, the past five years carrying salaries of from £500 to £2,000, because I feel sure that there are plenty of available men with all the qualifications Mr. Hirst desires, if he will only make his requirements known, and give the salaries stated.

Personally, I can claim a public school and University training ; I have paid the "£300 or more" ; I hold a Certificate of Honour from University College, London ; I am a member of two of our leading Institutions, and I hold an appointment as commercial engineer and manager of a well-known firm. Still, I should be pleased to offer my services to Mr. Hirst if he will give the salary he talks of.

I have not, however, "allowed myself to be thoroughly trained by the G.E.C.," and I think this must be what Mr. Hirst wants ; but why will not the training and commercial experience gained with other firms do equally well ? Mr. Hirst must not expect trained men to join his firm at 10s. to 25s. a week, or double the amount, in the hope of obtaining better things when they can command more elsewhere.

Let Mr. Hirst advertise in the ELECTRICAL REVIEW, stating his requirements and the salary he is prepared to give, openly and frankly, and he will get what he wants ; and may I suggest to Mr. Hirst that one good commercial engineer, who can be commercial or technical as occasion requires, is worth three or more of the "late office boy" men.

Engineer.

The Electrical Profession as It Is.

May I again seek the hospitality of your valuable periodical, seeing that your correspondent "Inquirer," quotes repeatedly from my previous letter, and concludes with a question of wide import.

What can be done to classify the individual in relation to the electrical industry ? The answer to this is, I am afraid, beyond the scope of a letter, as it naturally extends into many fields, but it is a subject that has caused me much study, with results that may reach the ears of "Inquirer."

I would like to mention, however, that in many of the articles by Mr. Kilburn Scott in the ELECTRICAL REVIEW reference has been made to methods of certifying fully-qualified members of the industry which I think are applicable in this country.

The title "electrical engineer" should be as distinctive as "patent agent," "doctor," "solicitor," and the like, who have the protection of the court against impostors, seeing that it costs considerable amounts of money, combined with years of study before efficiency is reached, and their services to the community are nowadays almost indispensable.

Before much time passes I hope to see our most influential electrical engineers combine to draft a Bill to be laid before Parliament, a clause of which will insist that any person advertising himself as an electrical engineer must show proofs of efficiency and qualification, or must employ an engineer who is fully qualified before undertaking public contracts. Many other stipulations would, of course, be included.

W. Ellerd-Styles.

London, N.E., *February 19th*, 1912.

Peat Fuel in Russia.—It is announced from Berlin that a syndicate in which the St. Petersburg Electric Lighting Co., 1886, is interested, has acquired extensive peat fields near Moscow, where it is proposed to erect a large station for the supply of electric power to the district and the many works in the vicinity. It is also intended to transmit electrical energy to Moscow in order to render the St. Petersburg Co.'s station in Moscow independent, as far as possible, of the prices of naphtha and coal, which are subject to great fluctuations, and have at present reached an extraordinarily high level. It is said that the quantity of peat available is sufficient to cover the fuel requirements of the Moscow electricity works for a period of 100 years on the basis of the present production of power.

Success of Croydon Corporation Tramways Band.—The London and Home Counties' Amateur Band Association held their annual festival and contests on Saturday, 17th inst., at the Crystal Palace, when the Croydon Corporation Tramways Band was awarded second place in the Reed Band section. For this event a keen fight was made by all competitors, and we congratulate the Croydon contingent and their bandmaster, Mr. W. Ellis (late of the Fourth Devons and Second Queen's Regimental Bands), upon their well-earned success.

PARLIAMENTARY.

Standing Orders.—The whole of the Private Bills have now been before the Examiner for proof of compliance with Standing Orders, and a few have been postponed for further consideration. Amongst the Bills which have been reported as having complied are the London United Tramways, London Electric Railway, Edgware and Hampstead Railway, Birmingham Corporation, Hull Corporation, Brighton Corporation, London and North-Western Railway, Bognor Gas Light Co. (Electricity), Brighton, Hove and District Railless Traction, Hove Corporation Railless Traction, Metropolitan Railway, North Ormesby, South Bank, Normanby and Grangetown Railless Traction, Metropolitan District Railway, Brighton District Tramways, Metropolitan Electric Tramways, and Preston, Chorley and Horwich Tramways.

National Electric Construction Co.—In the case of this Bill, which seeks power to confirm a number of agreements entered into with local authorities by the predecessors of the National Electric Construction Co., a mistake with regard to the newspaper notices has led to the decision that Standing Orders have not been complied with, and hence the matter will have to go before the Standing Orders Committee, who will decide whether the Bill shall be allowed to proceed. It appeared from the evidence given that the advertisement which should have been sent to the Tunbridge Wells paper went to the Crystal Palace paper and *vice versa*.

Southall and Hounslow Railless Traction.—Several allegations were made as to the non-compliance with standing orders in the case of the Southall, Hounslow and Twickenham Railless Traction Bill, and the Examiner found there had been a failure as regarded newspaper notices in respect of Clauses 21 and 46, inasmuch as the intention of the clauses with regard to the powers to be conferred on local authorities, and of the power to the company to erect waiting rooms, &c., were not properly stated. This Bill also will have to go before the Standing Orders Committee.

Glasgow Tramways.—Amongst the Scotch provisional orders, the Examiner has found that Standing Orders have not been complied with in regard to tramway No. 6 in the Glasgow Corporation Bill. This is a proposal to construct about ½ mile of tramway, to commence in Canniesburn Road and to terminate in the parish of New Kilpatrick, in the County of Dumbarton. The proposal will probably be struck out of the order.

House of Lords' Bills.—Amongst the Private Bills which it has been decided shall originate in the House of Lords are the following:—Brighton Corporation, Brighton District Tramways, Brighton, Hove and District Railless Traction, Hove Corporation Railless Traction, London and North-Western Railway, and North Ormesby, &c., Railless Traction.

Petitions.—A large number of petitions have been deposited in the Private Bills Office against Bills originating in the House of Commons, including the following:—

London County Council Tramways.—By the Bethnal Green, Hackney, Islington, Lambeth, Paddington, Hammersmith, Stepney, Greenwich, and St. Pancras Borough Councils, the City Corporation, Metropolitan Railway, Great Western Railway, Great Eastern Railway, London Omnibus Owners' Federation, &c.

Metropolitan Electric Tramways.—Stoke Newington Corporation, London County Council, and Middlesex County Council.

National Electric Construction Co.—Hackney B.C., Fleetwood U.D.C., Rathmines U.D.C., Pembroke U.D.C., Gloucester Corporation, Blackpool Corporation, Canterbury Corporation, Tunbridge Wells Corporation, Poplar B.C., Taunton Corporation, and a number of gas companies.

Edgware and Hampstead Railway.—Sir J. Maple's Trustees, Hendon U.D.C., Middlesex County Council, and four others.

Metropolitan Railway Co.—By 20 petitioners, including the London Electric Railway Co., Central London Railway Co. and the Metropolitan District Co.

London Electric Railway.—By the Metropolitan and Great Central Railways Co., Metropolitan Electric Supply Co., Twickenham and Teddington Electric Supply Co. and 12 others.

Metropolitan District Railway.—By the Metropolitan Railway Co., Twickenham and Teddington Electric Supply Co., Wimbledon and Sutton Railway Co., Metropolitan Electric Supply Co. and nine others.

Southall, Hounslow and Twickenham Railless Traction.—By 11 petitioners, including the Metropolitan District Railway, London United Tramways and Metropolitan Electric Supply Co.

Keighley Corporation.—Yorkshire Electric Power Co., and 10 others.

London United Tramways.—By Middlesex C.C. and the Richmond Corporation.

Ramsbottom U.D. Railless Traction.—By the Lancashire C.C. and the Lancashire and Yorkshire Railway Co.

Electrical Smelting of Iron Ore.—According to Industritidningen *Norden*, the Stora Kopparbergs Bergslags Aktiebolag has recently placed an order with the firm of Luth & Rosén, for the electrical equipment of the new electrical furnace which the firm is now building at its ironworks at Domnarfvet. The order comprises three controllable, air-cooled single-phase transformers, as well as the complete outfit of electrical instruments. The furnace in question is designed for a consumption of 12,000 electrical H.P., and is the largest electrical furnace in Sweden.

LEGAL.

ATTORNEY-GENERAL *v.* SHEFFIELD CORPORATION.

(*Continued from page* 250.)

ON Thursday, February 15th, MR. DRUCQUER, continuing the opening of the plaintiffs' case, called attention to the section of the Electric Lighting Acts affecting the question. He pointed out that the section in the Gas Works Clauses Act enabling persons to be supplied with pipes, burners, meters and lamps was in no way present in the Electric Lighting Acts. The company from whom the Corporation acquired their undertaking was registered on May 3rd, 1892. It was called the Sheffield Electric Light and Power Co., Ltd., and it had very wide powers in its memorandum of association to which he would call attention. Following on that on June 27th 1892, they obtained their provisional order, which contained a definition of consumers' terminals which had been universally adopted by the Board of Trade, and on which great reliance was placed by the plaintiffs. If the interpretation which the Corporation desired to place on the general Act was correct, they would, under one section, be compelled not only to wire up to the premises, but right up to the lamp itself. When they came to the regulations his Lordship would find that the undertakers must supply a constant pressure. That pressure was in fact tested by inspection at the consumers' terminals, and it was the only place where it could be tested, owing to the loss of pressure which took place between the terminals and the lamps. The Sheffield Electric Light and Power Co. carried on its business down to the year 1897. In April, 1897, the Corporation gave the necessary notice to treat for the purchase of the undertaking, but the company resisted that on the ground that the Corporation was unable to provide the necessary Corporation stock with which to purchase the undertaking. An action was instituted for compelling the transfer, but the Corporation lost the action, and after that they had to strike a bargain with the company in order to effect their purpose. In the meantime, it was somewhat important to notice that in May, 1897, the company purchased the business of the Universal Electric Fitting Co., Ltd., and by that means they practically created the department of which complaint was made in this action. They obtained that business by the usual means. The Universal Electric Fitting Co. was wound up, and the Electric Light and Power Co. increased its capital for the purpose of securing the assets of the Fitting Co.

His LORDSHIP: Then down to that time were the company not supplying fittings and things?

MR. DRUCQUER said, so far as they knew, none. Evidence would be given by the relator himself, an electrical contractor carrying on a large business in Sheffield, that throughout the whole of this period the company were practically doing no serious fitting work, but were only supplying energy. It might be that they were doing some fixing of wires, but they were certainly not carrying on this important trade, which they took over from the Universal Fitting Co. in the very year that the notice to treat had been unsuccessful.

MR. SARGANT: Does my learned friend say that the company were doing only wiring business and not doing fitting business?

MR. DRUCQUER said he was stating that for all practical purposes this department, of which plaintiffs complained, was commenced in 1897. The company had power to supply lamps, and he had no doubt they did so, but really the business of which plaintiffs complained was practically commenced in 1897. The agreement eventually entered into between the company and the Corporation was dated March 11th, 1898, and was set out in the Transfer Act, which he would read. That showed that there were a number of contracts which were not completed at the time the transfer was carried out.—

His LORDSHIP: What became of the company after the transfer? Did it cease to exist, or does it exist as a trading company?

MR. DRUCQUER said the Act did not provide for the after existence of the company, and did not dissolve it.

MR. SARGANT said the contract provided for the sale of everything the company had got.

MR. DRUCQUER read the Transfer Act and the agreement scheduled to it. He agreed that the purchase included all the stock, including lamps and fittings, and that the Corporation took over certain contracts. Those contracts were set out in the defence, and were relied on there by the Corporation.

His LORDSHIP: Were there any continuing contracts, contracts for maintenance?

MR. DRUCQUER said not that he knew of. Particulars were ordered to be given, and none of the contracts disclosed in the pleadings came under the description of continuing contracts. Under the terms of the agreement, during the whole of the year 1898 the company were carrying on the business on behalf of the Corporation in consequence of the delay in procuring the Transfer Act.

His LORDSHIP: You say that a power to work out existing contracts does not necessarily imply a power to make fresh contracts.

MR. DRUCQUER assented. He said this was a pure bargain. The Corporation had to purchase the whole undertaking. They could not expect the company to leave out one department. In the case of a purchase by a Corporation they often had to purchase things they did not require, which they got rid of afterwards. That was often the case with the purchase of a tramway system by a Corporation for the purpose of electrifying it. The Corporation had to take over all the horses and stables, but as soon as they had taken over the whole undertaking they got rid of all that they did not want. That occurred particularly in the Manchester case, where the sum

involved was very large indeed, and all the horses and stables were useless to the Corporation.

His LORDSHIP: Was the company dissolved after this.

MR. DRUCQUER said he did not know that evidence would be given. The next Act he had to call attention to was the Sheffield Corporation Act, 1903. The Corporation relied on a certain section, but the facts that plaintiffs would establish were that the section was the result of a bargain that was made in committee. The powers sought by the Corporation in their original Bill were complete powers to carry on this very trade, now the subject of these proceedings, but notice of opposition was given on behalf of electrical contractors, and letters would be read.

MR. SARGANT: I shall submit that you cannot go into all this.

His LORDSHIP: I don't think you can. Most of these Acts contain a great deal that is the result of compromise.

MR. DRUCQUER said he would only state the fact. There was a compromise which was secured, instead of Sec. 26, of the original Bill, which contained the full powers that they wanted. Some importance turned on it, because of the powers given with reference to motors. Plaintiffs were complaining that motors were sold outside the defendants' boundaries, and they said that this section applied only to motors within the City boundaries.

Having thus occupied one hour and a-half in reading and commenting on the various statutes, MR. DRUCQUER said he now came to the facts of his case. Even supposing his Lordship accepted Mr. Justice Neville's decision in the Leicester case, having regard to the importance of the present case, they must go into the facts.

MR. JUSTICE EVE assented.

MR. DRUCQUER said he would first read the pleadings.

His LORDSHIP said he was fairly well acquainted with them by this time.

MR. DRUCQUER said there were some paragraphs he wished to call attention to. He was happy to be able to inform his Lordship that a print of the opening and of the evidence would be prepared and supplied to his Lordship.

MR. SARGANT: In view of what my friend has stated, it might be better to have it printed on House of Lords' paper at once.

MR. DRUCQUER quoted a decision of the House of Lords, in which Lord Macnaghten laid down that the test in these cases was whether the trading in question was reasonably incidental to their business as authorised by their Special Act. Proceeding, he remarked that the Corporation did not claim any powers to carry on the business outside their area, but the company whose undertaking they took over had no such limitation. What the plaintiffs complained of was that the Corporation were carrying on a business that was well known as that of an electrical contractor. There were thousands of persons in the country known as electrical contractors, and the evidence would be that all that the Corporation could do was the wiring for the purposes of supply up to the consumers' terminals as defined in the Confirmation Order and as defined in the Board of Trade Regulations. If his Lordship would look at the model which had been prepared, he would see that it showed the complete thing.

His LORDSHIP said he was fairly well acquainted with it, practically speaking.

MR. DRUCQUER having exhibited the model to his Lordship, and explained its working, referred to the Board of Trade regulations made in 1909, governing the supply of electric current. He said that the business of an electrical contractor started with the consumers' terminals and the whole of the fitting up was included in his business. His business was that of a general retail trade for the supply of every imaginable fitting in connection with electricity. It was a recognised trade, and it was what defendants were doing. Any passer-by might go into their shop and buy any article that was displayed. The Corporation kept a department where there were no restrictions whatever on the sale of these fittings. That they recognised there should be some limitation was disclosed by a minute of January 5th, 1906, in which the Corporation said that if work was executed by the department in question, it should only be for persons already consuming electrical current supplied by the Corporation or for persons about to become consumers. So far as this department was concerned, the Corporation had a proper shop and showrooms, and the only difference between them and that of an electrical contractor was that the Corporation had more money to expend. But it was open to everybody. There was no restriction whatever. A purchaser did not have to sign any undertaking that he was a consumer or ratepayer, or was about to become a consumer. He thought it would be well to read the whole of the matter relating to the minute of January, 1906. There was a resolution passed on December 5th, 1905, by the Council of the Sheffield Chamber of Commerce, stating that the Council had received a deputation from the Sheffield Electrical Contractors' Association on the subject of municipal trading as carried on in the electrical fittings and wiring department of the Sheffield Corporation. It went on, "The electrical traders are substantial ratepayers of the city, and by reason of the municipal competition to which they are subjected, they have convinced the Council of this Chamber that it is impossible to carry on their business. This Council hereby records its disapproval of the City Council carrying on this department with public funds, and recommends that a copy of this resolution be forwarded to the City Council in the name of the Chamber, and a copy of the same be given to the Electrical Contractors' Association for their use in the legal opposition they are pursuing." On January 5th, 1906, the Electric Light Committee of the Corporation considered this resolution, and passed the following minute:—"Resolved that this Committee regret that the Chamber of Commerce should lend itself to support the efforts of persons who desire to benefit themselves at the public expense, and that the Chamber should have passed the above resolution without first communicating with the Corporation to ascertain the facts of the case. The Committee recommend the City Council to inform the Chamber of Commerce that the wiring and fittings department of the Electric Supply Department was necessarily purchased at great cost, under Parliamentary sanction, as part of the undertaking of the Sheffield Electric Light and Power Co. The work is executed by the Department only for persons already consuming electric current supplied by the Corporation or for persons about to become consumers. That, in the opinion of the Committee, it is necessary in the public interests and for the maintenance of a high standard of work that the Corporation should continue to execute work of the kind referred to. That all persons and firms in the city carrying on the electric wiring and fittings business have commenced to do so since the business now carried on by the Corporation was first established. That if it be as stated, that the wiring and fitting contractors cannot carry on their business profitably, it is due to undue competition among themselves. That the Committee has, on several occasions, received deputations of the wiring and fitting contractors, and fully investigated their complaints, and they have entirely failed to substantiate any grievance against the Electric Supply Department or to show why the wiring and fittings business, purchased at great cost of public moneys (the debt for which is still largely unpaid) should be discontinued for the benefit of private traders. The Committee have no desire to injure the wiring and fitting contractors in their business. The Committee simply carry on the wiring and fittings department as purchased by them with as little competition to the electrical contractors as possible." Having regard to that, one must assume (said counsel) that it was honestly meant and was not made merely for publication purposes. The important fact was that from that date the Corporation were found to be supplying a great number of people, which showed the great difficulty there would be in giving any partial relief in this case. The Committee put on record a minute which they found great difficulty in carrying out, and they might have the same difficulty in carrying out any limited undertaking or injunction. He thought that plaintiffs would be able to establish that, both as regarded motors and the other matters, the Corporation had not only before this action but after it, executed a great number of orders outside their boundaries, and it was absolutely essential that they should adopt some system which would obviate the difficulties of which plaintiffs complained.

Counsel having occupied 2½ hours, mostly in reading Acts of Parliament, and orders, pleadings and other documents, had not concluded his opening when the case was adjourned.

On Tuesday, MR. DRUCQUER continued the opening of plaintiffs' case, and, after putting in certain answers to interrogations, read certain particulars delivered by plaintiffs in support of their allegations as to trading by defendants outside their area, in the supply of electric motors and their accessories. These showed goods supplied to firms in Manchester, Blackpool, Mansfield, Chelmsford, &c. Many of these items, he said, were admitted, but it must not be taken that they were the only instances. They were taken out of the books on inspection; but there were another hundred cases which had not been investigated very closely showing business to a large extent. Then, with regard to the allegation that public moneys had been expended in connection with this trade.

His LORDSHIP: How does that become material? If it is *intra vires*, I suppose they can carry it on?

MR. DRUCQUER said there might be some question that they had common law powers as a municipality to carry on this department. If so, plaintiffs would prove that the Corporation could not use statutory funds to carry on the business.

His LORDSHIP: Have they raised such a case in the defence? Their case appears to be that they are authorised by the Provisional Order and the Electric Lighting Acts, and that this trade is incidental to the supply of electrical energy.

MR. DRUCQUER said that in Paragraph 23 of the defence, the defendants denied that they had ever expended the proceeds of any rate levied by them, or any money forming part of the Borough fund, upon any of the trades or businesses in question. The defendants said they had (as they were entitled to do) expended moneys borrowed under Sec. 7 of the Sheffield Electric Lighting Transfer Act, 1898, and used the plant, premises, property, and servants acquired and employed for the purposes of their electric undertakings, for the purpose of erecting and installing electric light fittings and wires, and electric bell fittings and wires, within their area. That admission, he thought, probably carried plaintiffs far enough, in so far as it was necessary to prove that they had expended public money. Plaintiffs were prepared, if necessary, to prove that not only had defendants expended money borrowed under their special powers, but they had expended rates. There had been deficiencies which they had had to make up out of the borough funds. Plaintiffs had delivered particulars of that. He thought, however, that paragraph 23 of the defence was sufficient for their purpose. The amount of capital used in the business at the time the Sheffield Power Co. was taken over by the Corporation was, as shown by the Board of Trade returns, £83,975. He now proposed to proceed to the evidence (after quoting the judgment of Mr. Justice Neville in the similar action against the Leicester Corporation).

His LORDSHIP asked, as a matter of history, why this action, which was commenced in 1906, was being tried in 1912, when the Leicester case, which was commenced in 1909, was tried in 1910.

MR. DRUCQUER said that, as he understood the position, it was this. Difficulties occurred in 1907 in connection with getting discovery. Defendants maintained that the admissions they had made carried them the whole way, and they refused discovery. Soon after that a Bill was introduced into the House of Commons, which, if it had been carried, would have made this case, and all similar cases, un-

necessary, as it sought to give full powers to Corporations to carry on this particular work.

Mr. Danckwerts said he must enter his protest at once against the modern habit of quoting something that was intended to be done in Parliament. It was always done for purposes of prejudice. He submitted that his learned friend had no right to refer to anything that happened in Parliament.

His Lordship: He is only explaining, in answer to my inquiry why this case has been something like six years in getting to trial.

Mr. Danckwerts said it was no explanation at all, because this happened in 1907.

Mr. Drucquer said he was giving an explanation of the delay. The Bill in question was contested until the obnoxious clause was deleted altogether, and during that period the Leicester action was commenced. They got discovery and proceeded at once with that action. If the action against the Leicester Corporation had failed, there would have been no object in proceeding with this complicated action.

Mr. Danckwerts said he was instructed that for three whole years the action was allowed to sleep.

Mr. Drucquer said he had given the explanation.

His Lordship said plaintiffs were not prejudiced by it. It was only a matter of comment.

Mr. Danckwerts said the judgment in the action against the Leicester Corporation had been read, and he presumed his Lordship was going to follow that.

His Lordship said yes, so far as the facts were identical.

Mr. Danckwerts said the only differences between the two cases, he thought, were in the fact that the Sheffield Corporation took over the enterprise of an electric company under certain terms, and the existence of the Sheffield Corporation Act, 1903. Apart from that, there was no difference. What he felt about it was this, that if his Lordship was going to follow the case of the Leicester Corporation, then, of course, defendants must submit to it, and he did not propose to waste time in rediscussing it. He did not know whether they could not clear up the issues sufficiently to shorten the matter.

His Lordship said he was bound to follow the decision of Mr. Justice Neville.

Mr. Danckwerts said he noticed the other side had said the case would go the House of Lords.

His Lordship said that was a threat that was often used in the early stages of an action.

Mr. Danckwerts said he wanted to take advantage of that observation. He gathered that, subject to the two points he had mentioned, the case would really resolve itself into a question of taking evidence on certain points in order that the Courts above might have the facts judicially before them.

His Lordship said it would be a good thing if any admission could be made which would clear the ground and avoid a great deal of expenditure of time in taking evidence.

Mr. Danckwerts said he thought he could assist his Lordship to get to close grips. First, as regarded electric light fitting and wiring, defendants only claimed the right to do that for people who either took, or were about to take, electrical energy from the Corporation within the area of supply. That included the supply of fittings. They did not claim to do that with regard to lighting purposes for non-consumers. As regarded electric bells, a distinction must be observed. There were electric bells which were operated by the energy supplied by the Corporation. Those defendants claimed to supply on the same grounds as related to electric lighting. The second class of bells were those operated by local batteries, and which were not connected with the supply of energy. Defendants claimed the right to supply and install those, because they were mixed up with, and practically one operation, with the instalment of the electric fittings and wires for other purposes which defendants were entitled to perform. Defendants also claimed the right to do that under the Act of 1903. As regarded motors, they claimed the right of supply under the Act of 1903; first, whenever the motors were actuated by their energy; secondly, whether they were actuated by defendants' energy or not. They did not claim to supply energy outside the area at all.

His Lordship: It has been alleged that an American, for instance, can go and buy fittings from your department and take them away.

Mr. Danckwerts said that was an effort of imagination. They did not claim to supply electric light fittings to non-consumers.

His Lordship: That is a question of fact. Whatever you claim, or do not claim, Mr. Drucquer says you are, in fact, doing it.

Mr. Danckwerts: He will have to make that good. Continuing, he said their contention was that the Act of 1903 was not limited to the area, but they said they did not intend to carry on business outside the area. Of course, they were not allowed to supply energy outside the area. As regarded the transfer of the late company's business, the Corporation could not claim, and never had claimed, the power to carry on all the business which the company had power to carry on. Their claim was limited in the way shown in Sec. 3 of the Transfer Act, and they said they were not only entitled, but were bound to carry out the contracts and commitments of the company in force at the time of the transfer. They were entitled to deal with the stock-in-trade taken over from the company in a reasonable manner. They had never supplied any energy outside the area except temporarily to people who had it by orders of the Board of Trade. They had not done any wiring for electric lighting purposes for non-consumers since the action was brought, and had not done so since 1903.

His Lordship said he was thinking how far they could shorten matters by prefacing any order made, with the admissions and claims made by Mr. Danckwerts. That would bring them within one branch of the Leicester case. He understood Mr. Danckwerts also claimed the right to supply electric bells if the same were operated by energy supplied, or about to be supplied, by the Corporation, and also if they were operated by local batteries not connected with defendants' supply.

Mr. Danckwerts said yes in connection with the fitting of a supply under the Act of 1903.

His Lordship asked if counsel could agree on admissions which would satisfy both sides and shorten matters.

Mr. Drucquer said the admissions which Mr. Danckwerts had made were not broad enough. They were really all contained in the pleadings. But for those admissions it might have been that he could have carried his evidence much further as to what had happened inside the area.

His Lordship said he agreed that Mr. Drucquer was entitled to take up that attitude. It appeared to him that the only result of their discussion had been to lengthen the proceedings instead of shortening them. He thought that a great deal of what Mr. Danckwerts had said was admitted in the pleadings.

Mr. Drucquer: And it does not help me.

His Lordship: Then go on with your evidence.

Mr. Drucquer then called Mr. Wm. H. Patchell, who explained to the Court the usual mode of supply of electrical energy to the consumer, and explained the exhibits which had been produced to illustrate the mode of supply.

Cross-examined by Mr. Danckwerts: I gather that you are not familiar with the Sheffield Corporation undertaking?—I have not seen anything of it since it was bought by the Corporation. I only remember it in the days when Mr. Johnson was there running it; he was the engineer.

He was the manager of the old company?—Yes.

What did you see of it then?—Very little. Not much had been done in the way of street mains then. I do not claim any particular knowledge of the Sheffield undertaking.

Mr. Danckwerts put further questions regarding the supply of energy, and explained that he was trying to frame his questions in popular language.

His Lordship said he did not mind. Counsel was only reducing himself to the level of the tribunal.

Mr. Danckwerts (to witness): The wires inside the house after the consumers' terminals are just as important as the wires before you reach the terminals, are they not?—You mean just as essential. Certainly. The consumer's terminal is the point upon which you can put your finger as the point at which energy is supplied by the undertaking and at which the statutory pressure can be tested.

Mr. Drucquer said he had electrical contractors to give further evidence if his Lordship desired.

His Lordship said it was for counsel to decide.

Mr. Drucquer called Mr. W. R. Rawlings, director of Rawlings Bros., Ltd. He said he was an electrical contractor and engineer and had had 25 years' experience. His business as an electrical contractor was to put in wires and fittings inside the consumers' premises. His work commenced at the consumer's terminals. The undertakers supplied all the fittings up to the terminals. He prepared the models.

Cross-examined by Mr. Sargant: You are not familiar with the practice at Sheffield?—No.

You prepared your models without reference to the system in operation at Sheffield?—Quite.

Do you know that at Sheffield they do not have transformers in the consumers' premises as a rule?—I believe they do not.

Mr. Albert Davidson, the relator in the case, said he was a M.I.M.E. and carried on business in Sheffield as a mechanical engineer. He was an electrical contractor prior to 1904, but ceased that business owing to the competition of the Corporation. He knew of the Sheffield Electric Light and Power Co., and knew that down to 1897 they were doing practically nothing in supplying electrical fittings. The Universal Fittings Co. did supply such fittings and was an auxiliary of the other company. Both companies had the same directors, but otherwise they were separate companies. The Fittings Co. was absorbed by the Power Co. The Power Co. did not, to his knowledge, issue a catalogue of fittings until they took over the Fittings Co. The defendants had a substantial showroom in Sheffield, and the fittings were clearly exhibited to the public. It was an ordinary commercial showroom. He had been in, but not to buy things. There was no notice of any kind exhibited to indicate that only consumers of energy would be supplied with fittings.

His Lordship: Are the articles priced?—Witness: I could not say definitely.

Further examined: About two years ago there was an Electrical Exhibition at Sheffield, at which the Corporation exhibited very largely. There was no notice then that the Corporation only supplied consumers with fittings.

Cross-examined by Mr. Sargant: There were still seven or eight firms of electrical contractors in Sheffield carrying on business. He gave up his business owing to the competition of the Corporation, not because of competition with other firms. He stated that from his experience. He was a mechanical engineer, and perhaps had not quite the same knowledge and experience as his competitors, but he employed a competent manager who was skilled in electricity. He was doing the largest electrical jobs that were being done in Sheffield at the time, but it was subsidiary to his other business of a mechanical engineer.

Do you know that the Universal Fittings Co. did not do the wiring of houses at all?—Yes.

And that a considerable part of the business of the Sheffield Co. was the wiring of houses?—I don't know that as a fact. I know that they did it.

Further cross-examined, he reiterated that the two companies were practically working hand in hand. He had considerable local knowledge of the circumstances of their businesses.

You know the Corporation showroom is on the second floor?—Yes.

Does it not strike you as peculiar it should be on the second floor if they want to carry on a general business?—No, not having regard to the nature of the business.

Are there any fittings in the showroom which could be used except in connection with the 200 volts supply of the defendants?—I could not attempt to answer such a question. So far as my knowledge goes the showroom is a general showroom.

Are there any fittings shown which could be used in connection with any other supply of electricity except that given by the Sheffield Corporation?—I should prefer you to put that question to the manager of the department.

Mr. Sargant repeated the question, and Witness replied that he personally did not know.

Was there any attempt to advertise this showroom as a place where electric fittings could be purchased?—There is a general attempt in their current advertisements which they send out.

Mr. Drucquer produced a specimen advertisement, and Witness, replying to Mr. Sargant, said these advertisements were sent out to the consumers, together with the bills for energy supplied.

Further cross-examined, he agreed that the chief object of the Electrical Exhibition was to demonstrate to the inhabitants the advantages of taking a supply of energy from the Corporation for many purposes of the household.

Re-examined by Mr. Druequer: Did you find the competition of the Corporation the same as the competition of other contractors?—No.

Why not?—Because the Corporation were on privileged ground.

In what sense?—I mean that where the Corporation had an inquiry for supply they could, and they had, supplied lengths of main which, when an ordinary contractor supplied them, were charged as an extra. We could never get a clear statement as to what belonged to the mains department and what belonged to the fittings department.

Further re-examined, he was a consumer of energy supplied by the Corporation, and as such received their advertisements. He identified various advertisements, and added that on principle he always refused to have anything to do with the Corporation, except for the supply of energy. He should have stated that the Corporation showroom was on the first floor above the ground floor.

His Lordship: Are there an other makers of electricity besides the Corporation?—Yes.

And they can go to the Corporation for fittings?—Yes. One of the worst cases is where they had done so in regard to a private installation of Mr. Wild. I wrote to the Town Clerk about it. It is shown in their books. Mr. Wild's place is just within the city boundary, but there are no mains to it. There was no excuse for them doing that work, and it only shows what they will do if they are allowed.

Mr. Sargant: Did Mr. Wild ask for a supply?—I don't know.

Mr. Ernest George Dennen, electrical contractor, carrying on business at Sheffield, produced models he had made, showing the mode of supply by the Corporation, and explained it to the Court. He said he knew of a case where the Corporation had repaired a dynamo used for electro-plating. The dynamo was driven by a gas engine.

Mr. Sargant said this was not in the particulars.

Mr. Drucquer asked to be allowed to go into cases beyond the particulars.

His Lordship said he thought at present they had better confine themselves to the particulars. If it was necessary he would give plaintiffs further discovery to enable them to add anything to their particulars.

Witness, cross-examined, said he was a consumer of energy supplied by the Corporation. He did not know of any invitation by the Corporation in the advertisements to do work for anybody but consumers.

Mr. Robert Tweedy Smith, of the firm of Turner & Co., solicitors for the plaintiffs, gave evidence in regard to certain interlocutory proceedings in the action. He also detailed the proceedings in connection with the Bill in Parliament, and the action taken after the decision in the Leicester case, where the Corporation were restrained from wiring houses. There was communication between himself and the Sheffield Corporation on the subject of that decision, but beyond that there was no delay in proceeding with the action. On June 11th he went to Sheffield and inspected the books of the Corporation by an order of discovery, and took out particulars of the work carried on by the defendants. He selected certain particulars for the purposes of the present action, but he did not multiply instances unnecessarily. He had examined the accounts of the Corporation, and he had come to the conclusion that a portion of the rates was used for the purposes of the electrical business. In the year 1902 there was a sum of £164,164 17s. 2d., due to the treasurer from the electricity department, and there was a deficit on the borough fund of £4,865 3s. 7d. That was after giving credit for all the balances in the hands of the banks, and the various accounts and the deficits were carried to a combined account of income and expenditure of the district borough fund. That caused him to come to the conclusion that the borough fund had been used for the purposes of carrying on a portion of the electrical undertaking. It could not be said that the surplus resulting from trading could be utilised to make good any deficiency, because the accounts showed there had been a series of losses for some time.

Cross-examined by Mr. Sargant: He was not a chartered accountant, but he had a considerable knowledge of accounts, and particularly of Corporation accounts. He admitted that he could only show there was a loss on the fitting and wiring department by inference, but the engineer in his report said there was a loss.

Can you contradict these figures? In 1902 there was a profit of £953 on wiring and fitting alone.—There is no such item in the account.

No, the accounts were kept together. Do you contradict the facts that the profits on wiring and fitting were as follows:—In 1903, £2,645; in 1904, £2,676; in 1905, £2,172; in 1906, £1,503; 1907, £1,663; 1908, £2,042; 1909, £3,211; 1910, £2,959; and 1911, £2,966. Are you prepared to say that the accounts you have got there enable you to contradict these figures in any way?—If you say the figures are hidden in some other portions of the accounts, I can't contradict it; but if that is so, they are not complying with the Board of Trade regulations.

That is our point. You said the published figures showed that there had been a loss. I only said by inference. I do not carry it beyond that.

This concluded plaintiffs' case.

For the defence, Mr. Danckwerts said he would postpone his speech, and at once call

Mr. Jas. Swinburne, F.R.S., M.I.C.E., who, by means of a model, explained to the Court the various means of storing and distributing electrical energy, and the improvements which had been made in the matter in recent years.

The hearing was adjourned.

On Wednesday further evidence for the defence was heard, the witnesses being Mr. Swinburne, Mr. S. E. Fedden, Mr. J. W. Wright, the City Treasurer of Sheffield and Mr. J. W. Barnes, commercial manager of the Sheffield electricity department.

(To be continued.)

Musker (1901), Ltd. *v.* Bessemer & Co.

In the Nisi Prius Court of the Liverpool Assizes, on February 14th, 15th and 16th, before Mr. Justice Bray (without a jury), plaintiffs, a firm of hydraulic and electrical engineers, Liverpool, brought an action, for balance due for an electric crane, against defendants, a large steel and iron company, at Bolton.

Plaintiffs' case was that on May 19th, 1911, a crane supplied by them was, subject to certain complaints, ready for the contract test. Subsequently some faults developed, and plaintiffs' representative went to Bolton to see whether they needed his attention. Before he began to make any adjustments, the crane was being used by defendants to carry a number of steel billets, and got damaged to a serious extent. The question to be tried, said counsel, was whether plaintiffs or defendants were responsible for the broken crane. Plaintiffs contended that the crane was used for lifting and carrying a weight of 10 tons 6 cwt. at a radius of 25 to 29 ft. from the centre of the crane instead of 15 ft. The theory was that the crane, travelling along the lines in a position of unstable equilibrium, struck some obstruction on the line, which caused it to over-balance.

Evidence in support of plaintiffs' case was given on February 15th. Counsel for the defence reserved his remarks, and called evidence to prove that there was a defect in the crane.

Defendants gave evidence that there was no obstruction on the line, but that the accident was due to the slewing pinion catching across a projecting bolt on the carriage of the crane, causing the load to swing and bring the crane over.

The Judge came to the conclusion that plaintiffs' explanation was the correct one, and he therefore found for plaintiffs. It was agreed that the matter should be mentioned again in order to decide what form the judgment should take.

Cubey *v.* Olympia Skating Rink Co., Seddon and Hall.

At the South Shields County Court on 15th inst., before Judge Bonsey, Thomas H. Cubey, electrician, sued the Olympia Skating Rink Co., Henry Edward Seddon, Manchester, and William Hall, Bolton, to recover £59 16s. 8d., in respect of electrical goods supplied at the rink, and work done.

Mr. H. S. Mundahl, who appeared for the plaintiff, said that the matter had been brought into Court in order that the liability for the debt might be fixed. It appeared that, in 1909, Seddon, Hall and others, built the Olympia Skating Rink at South Shields, and the building was afterwards taken over by the defendant company. Some of the goods included in the claim were ordered by Hall, others by Seddon, but when the plaintiff applied to them for payment, they each denied liability; the company also denied liability, and said they did not order the goods.

It was mentioned that the Olympia Co. had paid £1 3s. 4d. into Court in respect of one item for which they admitted liability.

After evidence had been given as to the ordering of the goods, and legal arguments as to the relative position of the parties, the Judge said there was no doubt that the plaintiff had supplied the goods and done the work, and consequently he was entitled to the amount of the claim. What he was deciding was not the pecuniary rights between the defendants in the case. He was merely deciding that the plaintiff was entitled to recover against those people who gave him the orders for the work or the goods. He, therefore, gave judgment against the Rink Co. for the £1 3s. 4d. paid into Court, against Hall for £5 8s., and against Seddon for £53 5s. 4d.

Patrick Tuchy *v.* Belfast Corporation.

At the Four Courts, Dublin, last Saturday, before the Lord Chief Baron and a special jury, this case was concluded. The plaintiff, a member of the Royal Irish Constabulary, on August 16th last was riding a bicycle on the Shor Road towards Greencastle, Belfast

when he collided with a tramcar, the property of the Corporation. He sustained a fracture of the skull, and has since been under medical care. His case was that the servants of the Corporation were negligent in the driving of the tramcar.

For the defence, negligence was denied; and it was pleaded that the plaintiff had been guilty of contributory negligence. There was a suggestion that at, or just before, the moment of the accident the plaintiff, on his bicycle, was holding the back rail of the tramcar, and that this led to the accident, he having been negligent in not looking out for a car that was coming in the opposite direction, which was the colliding one. There was, however, evidence that the plaintiff had let go the tramcar some few minutes before the accident.

Counsel for the plaintiff—Messrs. A. M. Sullivan, K.C., James O'Connor, K.C., and S. A. Porter (instructed by Mr. Bernard Campbell). For the Corporation—Sergeant Moriarty, Messrs. Chambers, K.C., M.P., Wm. M'Grath, K.C., and T. Harrison (instructed by Mr. Frank Kerr).

Counsel having addressed the jury, the Lord Chief Baron summed up the evidence. He said the law was that if this man's injuries were caused by the negligence of the defendants' servants, without what the law called contributory negligence on his part, he was entitled to get compensation for his injuries. On the other hand, if the injuries were the result of two acts—one a negligent act on the part of the plaintiff, being one without which he would have never have sustained the injuries, then he could not recover damages. But there was a third proposition, namely, that if there was negligence on the part of the plaintiff, which, in fact, contributed to the accident, still, if the defendants' servants could by the exercise of due care and caution have avoided the consequences of the plaintiff's negligence, then the plaintiff was entitled to recover.

The jury, after an hour's deliberation, were unable to agree, and they were discharged.

Stoke Newington Borough Council *v.* Lane & Co.

At the Shoreditch County Court on February 15th, plaintiffs sued defendants to recover £4 7s. 1d., the cost of laying an electric light service, and £1 4s. 6d. for current supplied and meter rent at a shop in High Street, Stoke Newington. According to a report in the *Daily Telegraph*, the shop was opened for the supply of Coronation electrical devices, and defendants only stayed a few months. The Council, therefore, charged for the installation, as, under their ordinary conditions, no application for a shorter period than one year was to be accepted, except under special circumstances, in which case the entire cost of connection of the mains must be paid by the applicant. Defendant claimed that he was not entitled to be charged, as other Councils supplied 20 ft. of cable free of cost. After considerable discussion, Judge Cluer said that, in this case, the Council's conditions wanted altering to suit certain arrangements. This was a genuine application for a permanent supply, but, by force of circumstances, they went out, though that did not make them liable for the mains under the present rules of the Council. Had the application not been genuine, it might have been different. The laying of the mains could not be charged for, and there would be judgment for the balance. Judgment was accordingly entered for the plaintiffs for £1 4s. 6d. and costs.

Dinner in Honour of Prof. Unwin, F.R.S.—On February 10th, Prof. W. Cawthorne Unwin, LL.D., F.R.S., was entertained by about 200 of his past students at the Criterion Restaurant, Piccadilly. The dinner was organised by the Old Students' Association of the City and Guilds Central Technical College, with the intention of celebrating their late professor's year of office as President of the Institution of Civil Engineers, a position which has never before been held by an engineer who has devoted practically all his life to the teaching side of the profession.

The chair was taken by the President of the Association, Mr. W. Duddell, F.R.S., who proposed the toast of the evening, and showed the phenomenal growth of the college under Prof. Unwin by stating that in 1885, when the college was opened, there were only 35 students, whereas in 1904, the year in which Prof. Unwin retired from actual teaching, the roll of students was 349. The chairman proceeded to speak about the professor's personal influence on his students, and evidently expressed the general feeling of the meeting when he said that all had regarded him as a second father, and that he was beloved accordingly. Mr. H. A. Humphrey, one of Prof. Unwin's original students, warmly seconded the chairman's proposal.

Prof. Unwin said that he was very much touched by the expression of his old students' respect for their professor, and having given a short but very interesting autobiography, he gave particulars as to the distinguished careers of several of his past students, now scattered all over the globe. Since the opening of the college 175 students had become Associate Members of the Institution of Civil Engineers, while 16 had been elected to full membership, and 157 had taken the new degree in engineering of the London University. Prof. Unwin hoped that soon his old college would have three distinct departments for Civil, Mechanical and Electrical Engineering respectively.

The meeting was a great success, and the Association presented Prof. Unwin with a cigar cabinet as a tangible souvenir of the evening.

OUR LEGAL QUERY COLUMN.

[*Questions addressed to this column should be written on one side of the paper only.*]

"C. W. G." writes:—"I have been for some eight years tenant of a house, which I have wired and fitted up for electric light at my own cost. I am now leaving, and wish to know what fittings I am legally entitled to remove. (*a*) Can I take down ceiling roses? (*b*) Can I take down branch and main switches? (*c*) Can I take down distributing fuseboard and main fuses?"

*** This query raises the question as to how far electric fittings are fixtures. The rule of law is that whatever is fixed to the soil becomes the property of the landlord; and as walls and ceilings are themselves fixed to the soil, whatsoever is fixed to them must be allowed to remain *in situ* at the end of the tenancy. In general, articles standing by their own weight upon the ground, or upon foundations prepared for them, are not fixtures—*e.g.*, a wooden windmill resting upon a brick foundation (R. *v.* Otley (1830) 1 B. and Ad. 161). The question whether a particular article is a movable chattel or a fixture depends on the degree of annexation to the freehold and the object of annexation (Cosly *v.* Shaw, 19 L.R. Jn. 307); so it is conceived that if electric light is installed in a house, any fittings (apart from mere ornamental fittings) become the property of the landlord. Ceiling roses, branch and main switches, distributing fuseboard and main fuses would thus, it is submitted, become the property of the landlord.

BUSINESS NOTES.

Lamp "Stickers."—The British Thomson-Houston Co., Ltd., are now issuing a "sticker" for affixing to correspondence or stationery. It consists (as the accompanying illustration will show) of a reproduction of the "Sun's Only Rival" showcards, artistically printed in many colours on a circular adhesive label. Contractors who have not yet had any of these "stickers," or who have exhausted their stock, can obtain a supply on application to the publicity department of the company at Mazda House, 77, Upper Thames Street, E.C.

Lamp "Sticker."

Company Liquidations.—Wakelin Bros., Ltd., electrical engineers, 7, Tottenham Street, W.—The creditors and shareholders met on February 16th, at the Board of Trade offices, Carey Street, Lincoln's Inn, W.C., to select a liquidator and committee of inspection to act under the compulsory winding up order made against the company on December 12th, 1911, upon the petition of Mr. John Frederick Wakelin and other creditors, presented to the Court on November 23rd, 1911. Mr. W. J. Warley, Official Receiver, presided. The statement of affairs, lodged by Mr. J. F. Wakelin, managing director, showed liabilities £1,256, against assets valued at £601, and a deficiency of £1,955 with regard to the contributories. The assets comprised cash at bankers, £4; plant and machinery, £70; and good book debts, £527. The report of the Official Receiver states that according to the accounts which have been imperfectly kept, the company appears to have traded throughout at a small loss. In August, 1910, it obtained the exclusive agency for the South of England for the sale of a patent electric lighting set. The directors state that the first set supplied through the company proved to be defective and involved the company in considerable expense. The company claimed to be recouped by its principals and this led to litigation, which subsequently, on November 23rd, 1911, resulted in judgment against the company for £424 and costs. On November 24th, 1911, the Court appointed the Official Receiver to be provisional liquidator, and it being represented that it was desirable to carry on the business with a view to a suggested sale to a new company, the Court, on his application, appointed Mr. D. L. Honeyman, chartered accountant, of 18, St. Swithin's Lane, E.C., to act as special manager, he undertaking to indemnify the Official Receiver against loss. The business was carried on by the special manager until the date of the winding-up order, but trading in the meantime resulted in a small loss. Subsequently to the winding-up order an offer of £100 was made for the plant, machinery and stock, but the same was withdrawn. Steps were thereupon taken to remove the plant, &c., whereupon the superior landlord distrained for rent due. Upon the advice of the auctioneer employed by the Official Receiver, an offer of £70 was accepted for the plant, &c., out of which the rent, £34, and expenses of distraint, &c., were paid. The only other assets consist of cash in hand, £4, and book debts estimated to realise £527. The failure of the company is attributed by the directors to the litigation before referred to; also to the failure of a customer, and to lack of working capital. The chairman added that £66 had been received in respect of the book debts, and there was about

£100 in hand. A resolution was passed at both meetings for Mr. W. A. Henderson, chartered accountant, 3, Fenchurch Street, E.C., to act as liquidator, with the assistance of the following committee of inspection, viz.:—Mr. W. J. Rogers (Sun Electrical Co., Ltd.); Mr. Joseph Huskinson (D. Hulett & Co., Ltd.), and a representative of Fyfe, Wilson & Co., Glasgow. The following are the principal creditors:—

UNSECURED.			
Adnil Electric Co., Ltd.	£85	Royer & Borghys	£25
Dixon, Edward	80	Russell & Co., J.	18
Evered & Co.	47	Siemens Bros.	99
Bolding, John, & Sons, Ltd. ..	89	Simplex Conduits, Ltd.	26
Fyfe, Wilson & Co.	424	Sun Electrical Co., Ltd. ..	37
Honeyman, D. L.	34	Tibbs, Percy	33
Hulett, D., & Co., Ltd.	17	Wakelin, H. R.	42
Pfeil, Stedall & Son	52		

NATIONAL LIGHTING CORPORATION, LTD., 35, Cock Lane, London.—First and final dividend of 4½d. in the £, payable at 33, Carey Street, W.C.

Private Meetings.—C. SUCKLING (trading as C. Suckling & Co.), Brent Street and Golder's Green Road, Hendon, N.W.—An adjourned meeting of creditors in the above matter took place of February 12th. It was reported that the offer previously made by the debtor of 3s. 4d. in the £ had now been increased to one of 7s. in the £. It was recommended that this offer should be accepted, on the understanding that all the creditors agreed and that the composition in question should be paid within a period of 10 days.

Catalogues and Lists.—THE SANDYCROFT FOUNDRY CO., LTD., Sandycroft, near Chester.—New catalogue (H.B.) of 46 pages relating to their patent "Cascade" induction motors (Hunt's patents). A specification is given accompanied with diagrams of connections and half-tone views of the motors and parts, also pictures showing their applications in the driving of pumps, haulage gear, air compressors, &c. Many of the pages are occupied with table matter respecting efficiencies, speeds, weights and prices, dimensions, &c. Particulars of liquid and metallic starters and of special outfits for Cascade motors are given.

THE BRITISH ALUMINIUM CO., LTD., 109, Queen Victoria Street, London, E.C.—Twelve-page publication containing various information respecting the use that is being made of aluminium for motor and carriage building. A table appears of the physical and mechanical properties of brass, steel and aluminium, also one of a number of sections; a third table sets out the weight per square foot of aluminium sheet.

MESSRS. W. A. WALKER & CO., 38, Victoria Street, Westminster, London, S.W.—Eight-page booklet giving a list of their regular stock, sizes of bright steel bars, strip, and sheets for deep stamping.

THE STERLING TELEPHONE AND ELECTRIC CO., LTD., 200, Upper Thames Street, London, E.C.—Twelve-page art-paper booklet (No. 180) giving full descriptive notes, with half-tone illustrations and diagrams of connections of their portable infantry, cavalry and artillery telephones.

MESSRS. STOCKER & CO., Leipzig.—One hundred and fifty-two-page catalogue (in German) containing particulars and prices of a great variety of electric bells, telegraph and telephone apparatus and material, electric clocks, fire alarm, electro-medical apparatus, and other manufactures for weak currents. A number of tools and sundries and diagrams of connections are given at the end of the book.

MESSRS. SIEMENS BROS. & CO., LTD., Woolwich, Kent.—New catalogue, No. 542 (60 pages) in the firm's excellent standard style and form, containing full information regarding redesigned and improved Siemens water meters. In addition to a number of well executed half-tone pictures of the apparatus, there are many useful very clearly rendered explanatory sectional drawings. Dimensions, weights, and prices are given in tabular form. The contents of the catalogue may be indicated by the following names of sections:—Vane wheel meters (dry and wet running and larger types); water meter combinations; disk water meters; boiler feed disk water meters (for hot water), which should be of considerable interest to station engineers; full-bore water meters (for large quantities); and testing apparatus and tools.

THE BRITISH THOMSON-HOUSTON CO., LTD., Mazda House, 77, Upper Thames Street, London, E.C.—A new price list of Mazda drawn-wire lamps covering standard and fancy miniature types has been issued. The list has a front cover in colours, illustrating the firm's "Strength" showcard, with the "Sun's Only Rival" design at the top. The list contains concisely arranged tables of the various lamps, and notes relating to the advantages of the Mazda drawn-wire lamp and its applications. A number of photographs show the illumination of offices, shops and factories with Mazda lamps. A full-page set of illustrations shows all the sizes of Mazda lamps made to scale, and facing this a table of sizes and voltages gives full data thereon. In addition to a complete range of standard types, the list contains a line of Mazda fancy lamps, candle and twisted flame, with drawn-wire filaments. Copies can be obtained on application.

THE ELECTRIC AND GENERAL STORES CO., 102 and 104, Albion Street, Leeds.—Illustrated and priced leaflets relating to the "Lodge" sparking plug, the Jones speedometer, the Claudel-Hobson carburettor, and the Dietz motor lamps.

THE WILSON-WOLF ENGINEERING CO., LTD., Thornton Road, Bradford.—Section III (eight pages) of their catalogue of type "C" motors and dynamos for direct current, from ½ to 6 H.P. A brief specification is followed by tabulated code-words, powers, speeds, and prices for open, protected or enclosed ventilated machines, motor-starters, spare parts, &c.

THE UNION ELECTRIC CO., LTD., Park Street, Southwark London, E.C.—Advance copy of a 12-page booklet entitled "A Jewel of a Lamp," containing a non-technical description of the "Kohinoor" semi-enclosed D.C. arc lamp and its advantages, prepared for the purpose of appealing to consumers. Money tables are worked out showing the economy of this system of lighting as compared with grouped metal-filament lamps. Copies of the pamphlet will be sent to contractors on application.

MESSRS. POPE'S ELECTRIC LAMP CO., LTD., Willesden, London, N.W.—Folder regarding their metal-filament lamps, and stating prices of same and results of tests made at the Westminster Electrical Testing Laboratory. An effective cartoon shows the disgust of a couple of prepayment gas-meter thieves, at the small sum found in the meter—the Pope lamp being to blame for the economy.

MESSRS. JULIUS SAX & CO., LTD., 24A, High Street, New Oxford Street, London, W.C.—Sixty-page catalogue of electric bells of various qualities and types, including continuous-ringing bells, indicating (mechanical replacement) bells, bracket, circular, water-tight outdoor, gas and water-tight and other bells. Relays, complete bell sets, indicators, fire alarm indicators, pushes of many kinds, batteries and wires, are all illustrated and priced. Special attention is directed to the firm's rubbing-contact bell.

Books Received.—"*Bulletin* of the Association des Ingenieurs Electriciens." October-November, 1911. Liége: The Association. Price 11 fr.

"*Journal* of the American Society of Mechanical Engineers." Vol. 34, No. 2. February, 1912. New York: The Society. Price 35 cents.

"*Bulletin* Mensuel de la Société Belge d'Electriciens." Vol. XXIX, No. 1. January, 1912. Brussels: E. Bruylant. Price 1 fr. 75.

"*Transactions* of the Institution of Engineers and Shipbuilders in Scotland." 1911-12. Glasgow: The Institution.

"*Journal* of the Franklin Institute." Vol. CLXXIII, No. 2. February, 1912. Philadelphia, Pa.: The Institute. Price 50 cents.

"*Proceedings* of the American Institute of Electrical Engineers." Vol. XXXI., No. 2. February, 1912. New York: The Institute. Price $1.00.

"Fire Tests with Textiles," and "Fire Tests with 'Pyrene' Fire Extinguishers." 1912. London: The British Fire Prevention Committee. Price 2s. 6d. each.

"Resistance Coils for Alternating Current Work," and "The Measurement of the Inductances of Resistance Coils." By H. L. Curtis and F. W. Grover. September, 1911. Washington: Government Printing Office.

Boletin de la Sociedad de Fomento Fabril. Vol. XXIX, No. 1. January 1st, 1912. Santiago, Chile: The Society.

"The Steam Turbine." By Robert M. Neilson. 1912. London: Longmans, Green & Co. Price 18s. net.

Applications of Aluminium.—The windows of the BRITISH ALUMINIUM CO.'s premises at 109, Queen Victoria Street, E.C., just now afford an interesting object lesson in the versatility of aluminium. Mounted in an artistic framework of polished aluminium are 12 panels which bear samples demonstrating the various forms of the raw material and the processes involved in its manufacture. The first two panels under the headings "Ingots" and "Slabs" show specimens of notched bar and slices cut from the company's standard forms of rolling slab. Wire bars and rods, round, square and of rectangular section, are represented in great variety under their respective headings. The panel devoted to sheets gives a selection of the different forms of finish to which aluminium lends itself, whilst the exhibit of sections shows angles, channels, lap-plates and mouldings of the many forms which the company regularly supplies. Tubes are displayed in a number of forms and sizes, and the panel devoted to alloys is equipped with examples of castings for motor and other work. The last two panels, devoted respectively to "wire" and "cable" give some idea of the fields in which aluminium is so extensively replacing copper.

An Everlasting "Sunbeam."—THE SUNBEAM LAMP CO., LTD., have received from a well-known supply engineer the following letter:—

"We are forwarding to you to-day a lamp of your manufacture, that has *not yet given out*, and it may be of interest to you to know that it has been burning in my own house on an average of six hours every evening, since October, 1908, which means a life of over 7,600 hours."

This is certainly a remarkably good record.

Diesel Oil Engines.—We learn that in the fortnight between January 28th and February 10th, orders were received by the MASCHINENFABRIK AUGSBURG-NURNBERG A.G. for 20 M.A.N. Diesel oil engines of altogether 10,570 B.H.P. Amongst these are two horizontal single-acting two-cycle engines, each of 2,000 B.H.P., ordered by L. Mannstädt & Co., of Kalk, near Cologne, and two horizontal double-acting four-cycle engines, each of 1,600 B.H.P., ordered by the Municipal Electricity Works, at Halle, where one engine of this size has been running for some time.

Social Events.—The seventh annual dinner of the employés of MESSRS. A. REYROLLE & CO. was held on February 17th at the Collingwood Restaurant, Newcastle-on-Tyne, a company of over 150 being present, under the chairmanship of Mr. Reyrolle. After the loyal toast, the toast of "The Firm" was proposed by Mr. F. Coates, who expressed the opinion that the success of the

firm was, to a large extent, due to the mutual regard which existed between the employers and the employés, and which in turn was due to Mr. Reyrolle, who was accessible to all. The firm had shown an example of progressiveness in the past, and he ventured to prophesy that the rate of progress would be fully maintained in future. At the present moment they had in hand a couple of orders for 6,000 and 20,000-volt switchgear for a large supply company in the United States, and he thought that to send switchgear to that country was no mean achievement.—Mr. Reyrolle, in reply, thanked Mr. Coates for his words of appreciation, and said that it was his ambition to do more, if possible, to make all the employés feel that they had a personal interest in the firm. They had certainly made wonderful progress during the past 10 years, and he was confident that by keeping together and working in harmony they would make still greater progress. As had been said, their manufactures would shortly be represented in the States by several high-tension ironclad panels, and the firm's exhibit at the Turin Exhibition had been very favourably commented upon. Several of the employés contributed to a varied programme which followed, and the evening was very successful.

To-night, at 8 p.m., at the Pillar Hall, Victoria Station (S.E. and C.R.), the staff smoking concert of the Charing Cross, West-End and City Electricity Supply Co., Ltd., is being held.

On Friday, 16th inst., the fifth annual dinner and smoking concert of the workmen of the Sunbeam Lamp Co., Ltd., Gateshead, was held in the Collingwood Hotel, Newcastle, a large number being present, under the chairmanship of Mr. T. J. Grainger, the general manager of the company. There were also present Mr. H. W. Edmundson, works manager, Mr. J. Gledson, the Northern District superintendent, and Mr. R. M. Beresford, secretary. After the loyal toast was given, the success of the company was proposed by Mr. G. Barras, the manager of the glass works, and responded to by Mr. Grainger, who spoke optimistically of the future of the company. A successful musical programme was given by Messrs. E. Batey, T. A. Golightly, A. H. Rushton, R. M. Beresford, T. Onions and A. Bell, with Mr. G. W. Danskin as accompanist. A hearty vote of thanks to Mr. A. H. Rushton, who made the arrangements for the evening, terminated the proceedings.

The annual dinner of the staff of the "Robertson" and "Osram" Electric Lamp Works was held on Friday, 16th inst., at the Clarendon Hotel, Hammersmith. Close upon 100 sat down under the chairmanship of Mr. C. Wilson, the popular manager. An excellent programme was provided by members of the staff, the principal item being an amusing playlet called "House Full," which was briskly played by members of the Dramatic Society, who deserve great credit for the excellent way in which it was done. Miss D. Dallender and Miss E. Drasd ably filled their respective parts, while Mr. H. Damerell, the producer, and Mr. J. Minson kept the audience amused throughout. The toast list included "The King and Royal Family"; "The Allied Firms," briefly and pithily proposed by Mr. J. T. Fletcher; and "The Visitors," proposed by Mr. F. P. Driver, and responded to by Mr. White and Mr. Sydney Rentell. Mr. P. Pring proposed "The Chairman," and in response, Mr. Wilson reciprocated the kindly expressions of the proposer, and referred to the general growth of factories in Hammersmith, theirs being the second largest; he pointed out that far from factories being conducive to empty houses, as had been prophesied, the reverse was the actual fact.

Advance in Prices.—Messrs. A. Seage & Co., of Hammersmith, announce that, in consequence of the continual advance in material and wages, they have had to advance prices by 5 per cent. from Wednesday, February 21st.

Mexico.—The British Vice-Consul at Guadalajara (Mr. P. G. Holms) reports that a firm of importers of that place desires to get into touch with British manufacturers of agricultural machinery, producer gas engines, centrifugal pumps and material for electrical installations. Any further communications regarding the inquiry should be addressed to the British Vice-Consulate, Guadalajara.—*Board of Trade Journal.*

Aberdeen Destructors.—The Corporation Cleansing Committee, in the selection of contractors for the installation of a dust destructor, is to confine its attention to Heenan & Froude, Manlove, Alliott & Co., and Hughes & Stirling. A deputation is to satisfy itself as to the comparative merits of the destructors of these firms before accepting tenders.

Trade Announcements. — Messrs. Gillespie and Beales, of Amberley House, Norfolk Street, Strand, W.C., have recently been appointed by the Limmer Asphalte Paving Co., Ltd., as their sole selling representatives in the United Kingdom for their joint-box compounds and insulating bitumens.

The General Electric Co., of New York, have acquired from the Sandycroft Foundry Co., Ltd., the sole right to manufacture and sell in the United States of America and its colonies and dependencies, cascade motors of the "Sandycroft-Hunt" patent type. We are informed that the application of these cascade motors is becoming more and more general for all purposes where slow and variable speeds are required. The possibility of obtaining such speeds has now made alternating current as useful for industrial purposes as direct current.

The Crypto Electrical Co., of Bermondsey Street, S.E., have now a new telephone line (No. "2807 Hop") in addition to 12830 and 12831 "Central."

Mr. H. Cressall informs us that he is making an extended stay at Mr. Schniewindt's works at Neuenrade, in Germany—prior to making arrangements for manufacturing resistance nets in England. All communications relating to resistance nets, previously addressed to him at 13, Summer Row, Birmingham, should be sent to him at Neuenrade, Westphalia, Germany, until further notice.

Imeson, Finch & Co., Ltd., electrical and tramway engineers, Stockton-on-Tees.—The receiver and liquidator of this company announces that he has sold the business and trading effects of the company to Messrs. Imeson, Finch & Co. (1912), Ltd. The latter company has issued notice to the same effect, intimating that it is carrying out all contracts and trading engagements commencing from January 31st, 1912.

For Sale.—The Trafford Power and Light Supply Co. (1902), Ltd., have for disposal a quantity of electrical plant. The Greenock Corporation has for disposal one 100-kw. Belliss-Silvertown balancer set, and two 150-kw. Belliss-Silvertown shunt or compound sets. The Rotherham Corporation has for disposal a 165-kw. d.c. steam set. The Polytechnic Estate, Ltd. (Wimbledon), have for sale a quantity of gas and electric plant, batteries, &c. See our advertisement pages to-day.

Bankruptcy Proceedings.—Under a receiving order made against the British Accessories Co., 119, Pentonville Road, London, N., the first meeting of creditors was held on Tuesday, last week, at Bankruptcy Buildings, Carey Street, W.C., Mr. E. Leadam Hough, Senior Official Receiver, presiding. The chairman reported that Ernest Dunstan Hawker and Arthur Sydney Finch had attended under the proceedings, and the former had stated that he entered into partnership with Finch in November, 1910, for the purpose of carrying on business under the style of the British Accessories Co. It was only a verbal partnership, and each of them provided a sum of £50 by way of capital. In February of the following year they bought from the Standard Plating Co. a wind tin-sign business which had been carried on as the Bright Sign Co. The purchase price was £190, of which they paid £20 down in cash, whilst the balance was to be paid by monthly instalments, but they had only paid three of these, and now alleged that the business had been misrepresented to them. As a matter of fact, the debtors began proceedings against the Standard Plating Co.; they, however, discontinued them owing the want of ready money. They carried on their ordinary business until the beginning of October last, when the petitioning creditors pressed them for payment, and they were then compelled to close down. No statement of affairs had yet been lodged, but the debtors had estimated their liabilities at £320, whilst their only available assets were some book debts of the face value of £55, which they thought would realise £40. The stock-in-trade and machinery, together valued at £21, was required to meet the claim of the landlord. The serious feature of the case was that, shortly before they committed the act of bankruptcy upon which the proceedings were instituted, the debtors executed a bill of sale over their household furniture in favour of Mrs. Hawker. No money passed at the time, and the bill was said to have been given in order to secure payment of money then owing to her in respect of loans. The failure was attributed to want of capital. There was no offer of composition before the meeting, and the case was left in the hands of the Official Receiver to be wound up in bankruptcy in the usual manner. Proofs of debts were lodged by:—

Standard Plating and Kupron Works, Ltd. ..	£136
Tempered Spring Co., Ltd.	12
Gaskell & Grocott	59

C. O. McMillan, electrician and cycle dealer, High Street, Portmadoc.—First meeting, February 29th, at Chester; public examination, March 25th, at Portmadoc.

LIGHTING and POWER NOTES.

Accrington.—A L.G.B. inquiry into the application of the Accrington Council to borrow £33,750 for the local gas generating scheme and electrical extensions at Altham and Clayton-le-Moors, will be held on February 27th.

Barnes.—At the last meeting of the Council, the Lighting Committee reported that, after considering a lengthy report by the engineer on differential tariffs, it had decided to approve the Norwich system of charging, and had referred the whole question back to the engineer for further report.

Belturbet.—At the monthly meeting of the Urban Council, the agreement between Mr. Cave and the Council for the lighting of the town by electricity for the next three years was submitted by the clerk, and approved of.

Birmingham.—The Corporation is stated to be going to reduce electricity charges all round. At present, the charges at Aston—which was recently absorbed by the city—are much lower than elsewhere in the area, varying for lighting from 3d. to 2½d., the latter figure for all in excess of 1,500 units per quarter, while in Birmingham the charges vary from 4d. to 2d. (for over 20,000 units per quarter).

Brighton.—The T.C. has decided to devote £3,000 from the present year's electricity profits (estimated at from £6,000 to £8,000) in relief of the rates.

Cardiff.—The City Council, with a view to improving the electric lighting in the principal thoroughfares and effecting an immediate reduction in the cost, has ordered the electrical engineer to proceed forthwith to convert the old electric lamps to flame arc and high candle-power metal-filament lamps.

Carlisle.—The T.C. has informed the R.D.C. that it intends extending the supply of electricity to Stanwix as soon as the work can be undertaken.

Canada.—The New Brunswick Hydro-Electric Co., with $1,500,000 capital, which proposes to supply St. John with cheaper heat, light and power, developed from water powers on the Lepreaux River and neighbouring streams, will apply to the Legislature in March for incorporation.

The Cedar Rapids Power Syndicate, of Montreal, headed by D. Lorne McGibbon, has now assumed the name of the Cedar Rapids Manufacturing and Power Co. Detailed plans of the company's operations on the north side of the St. Lawrence are so far advanced that tenders will be called for the dyke and power house without further delay; it is the company's desire to begin active operations at the plant in the early spring. The capital of the company has been placed at $10,000,000.

Chesterfield.—The T.C. has applied to the L.G.B. for a loan of £7,000, for extensions to the electricity works.

Dundee.—The Electricity Committee has under consideration the question of encouraging extra business by granting a reduction in the charges. The scheme before the Committee was as follows:—For power purposes the charge would be 1½d. per unit for the first 10,000 units, the next 40,000 units to be charged at ¾d. instead of the average price of 1½d. All units over 50,000 would be charged at ¾d., but this concession would only be granted to reasonably steady and constant loads, and not to intermittent users. The present rate for 10,000 units is from 2½d. to 1½d. per unit. The rates for small power users were to be reduced from 2½d. to 1½d. per unit, and the larger power users were to have a 10 per cent. reduction. The tramway rate would be reduced from 1½d. to 1d. per unit. A proposed reduction in the case of shopkeepers and domestic users was also considered, this being on the basis that if they guaranteed the present consumption they could have all the extra supply required at the rate of 1½d. for the first 100 units per quarter, and over that at the rate of ¾d. Current to be supplied at these rates, no matter for what purpose it is used. The present lighting rate is from 3½d. to 2½d., according to the amount used, and the heating and cooking rate from 1½d. to ¾d. These proposed changes involved a reduction in revenue of about £2,400 per annum. After full consideration, the Committee decided to consent to the reductions in the case of the large power users, but to defer consideration of the other cases meantime.

The question of the new sub-station was again considered. Mr. Richardson, the engineer, said the load had greatly increased in the south of the city and also at the harbour. He had had complaints regarding the pressure, and because of the growing load he was of opinion that a new sub-station was required. To install new machinery at the Dudhope station and lay an extra cable would cost between £9,000 and £10,000, while the erection of a new sub-station would only amount to about £7,000 It was agreed that the engineer prepare a report on the subject.

Dunoon.—At a meeting of the T.C. a letter was read from the B. of T., stating that it proposed to revoke the Dunoon Electric Lighting Order (1906) within three weeks from January 26th, but that it was prepared to consider any further representation the Council might have to make. The Council agreed at a later meeting to send a deputation to see the B. of T. officials.

Falkirk.—At a conference between representatives of the Eastern District Committee of Stirling County Council, and a Committee of Falkirk T.C., it was stated that the meeting was held on the initiative of the T.C. to consider the electric lighting order being promoted by Mr. George Balfour, of London. On behalf of the County Council, however, it was pointed out that it had practically arranged terms with the promoter of the order, which would come before the B. of T. this week. No finding was arrived at as a result of the conference.

Germany.—The electricity station at Heinitz which supplied power and lighting for the industrial district of the Upper Saar Valley and the Palatinate was recently burnt out, depriving numerous towns and villages of their supply and throwing out of work 20,000 men.

Goole.—The D.C. recently discussed the three electric lighting proposals for some hours, and decided to obtain a copy of the Yorkshire Power Co.'s draft agreement.

Great Yarmouth.—The electrical engineer (Mr. Gordon Bryant), in reporting a breakdown at the generating station caused by the fracturing of a 6-in. diameter bye-pass steam pipe, said that the steam, filling the engine room, thoroughly saturated the electrical machinery with water, and rendered the main dynamos useless for the time being. The supply, however, was partially restored after a period of three hours, while two hours afterwards the whole of the private and a greater part of the public lighting was running as usual. Seventeen tramway trolley standards on the Marine Parade are to be fitted with electric light by means of up-to-date flame arc lamps of 2,500 C.P. each for a period of 16 weeks from June 7th, at an approximate cost of £80 per season.

Hastings.—Whilst opening the important thoroughfare at the corner of Robertson Street recently, to lay a high-pressure gas main, the employés of the Gas Co. drove their wedges through six pipes containing electric cables, thereby extinguishing the lights in the central district of the town for an hour.

The Corporation decided at its meeting at the end of last week to extend the electric light mains in London Road, St. Leonards, so as to embrace St. Matthew's Gardens and the upper part of the thoroughfare at a cost of £326. By carrying out the work, 20 gas lamps will be transformed to electric lighting, showing a saving of 30s. a year per lamp.

Hornsey.—At the last meeting of the B.C., Councillor Double moved: "That the Council allow to consumers of electric current for lighting purposes when charged for at a flat rate, a discount of 5 per cent. on the first 100 units consumed off the quarterly accounts, if payment is made within one calendar month from quarter-day." He said that the Electricity Supply Committee had been considering the matter for some time. In the meantime the woes of the small consumers, who were the backbone of the undertaking, continued, and they had no redress. Upon the chairman of the Committee stating that the whole question of charges would be thoroughly discussed by the Committee, Councillor Double withdrew his motion.

Huddersfield.—The borough treasurer's financial statement relating to the Corporation electricity works shows that the income for the year ended December 31st, 1911, was £39,592, compared with £35,209 for 1910. The various items were:—Single-phase lighting, £22,842; single-phase power, £4,032; three-phase power, £8,449; street lighting, £812; hire of motors, meters, &c., £3,250; and fittings service, £207. The expenditure amounted to £23,978, compared with £21,516, leaving a balance surplus of £15,613, against £13,693 for 1910. Interest on loans absorbed £6,763; contribution towards redemption of debt, £4,776; and public works board (amount repaid), £1,607; leaving a net surplus of £2,466, compared with £656 last year. The surplus has been transferred to the depreciation and contingencies account, which now stands at £4,988, compared with £6,123 for the previous year. The Committee has also decided that an amount equal to 2 per cent. on the capital outlay be in future transferred each year to the depreciation and contingencies account.

Lancashire.—The Lancashire Electric Power Co. has notified various local authorities that in the event of a coal strike it will be able to supply the maximum demand of the whole of the consumers for six weeks, and to supply sufficient current to enable power consumers to run their works for a period of eight or ten weeks.

London.—Marylebone.—At a recent meeting of the Council a report from Mr. Carson Roberts, the L.G.B. auditor, on his audit of the accounts of the electricity department for the year ending March 31st, 1911, came under consideration. He stated that several members of the Council had attended the audit and had raised objection to transactions of the sales department and to items of account relating thereto. As these objections related to questions of policy it was not his duty to refer to them with the exception of two. The first was as to whether the Council observed the limitation placed upon them by Sec. 20 (2) of their Act of 1904, or whether in fact they "themselves execute the wiring of private property" in contravention of that section. The other question was as to whether the separate statements of the receipts and expenditure of the sales and publicity department as shown in the general ledger, and the profit and loss account of the sales department shown in the minute book, were in all respects correct statements. The following question had also been raised, which the auditor stated may concern his next audit, viz.: Sec. 20 of the Act, 1904, clearly empowers the Council to trade in fittings and electric materials of any kind and to enter into contracts for installing the same, but it provides that "they shall not themselves execute the wiring of private property except between the main of the Council and the consumer's meter." The practice which had prevailed under the new sales department during the year has been that of obtaining the actual labour for this wiring work through a contractor, who receives a commission on the labour cost. There is no putting out of the wiring to contract, for work is arranged and directed by the officers of the Council, the allotment of the workmen's time is controlled by them, the supply of all material, and some of the tools, is arranged by them, and, in some instances, even the engagement of extra men. No other contractor has the opportunity of tendering for the work which is executed on this plan. In some cases the work is offered to contractors in the ordinary way, and the question as to compliance with the statutory provision only arises when the plan above mentioned is followed. In the auditor's opinion, considerable alteration would be necessary to bring this plan within the terms of the Sub-section, which appeared to contemplate an actual contract or sub-contract for the wiring. A proposal for revising the arrangement had been formulated by the general manager in September last, and this proposal, if generally applied, would involve a veritable execution of the wiring through contractors. Under these circumstances, he did not think it was necessary for him to make any further report, or to take any action in the matter on this occasion. In dealing at some length with the attempt of the Council to separate "the sales" from the "publicity" transactions in the ledger account, Mr. Roberts said that it had been abandoned because its completion involved a large number of estimated figures which could not be, or profess to be, by any means, accurate or reliable. It was argued, he states, that (1) experimental work in testing apparatus; (2) the cost of providing and setting up apparatus for the approval of prospective users; and (3) the losses arising on the stocking of new inventions which may prove to be unsaleable, are to be charged as part of the cost of developing and advertising the general undertaking, and not as sales department expenditure, even when a municipal authority has statutory power to engage in the trade of selling these appliances, some of these items of expenditure might be of questionable legality, particularly in the case of No. 2 mentioned above, and it is only on the strength of the very wide powers conferred upon the Council by their local Act of 1904, which gives unusual freedom

in these matters, that they have been passed at audit. In his opinion, as it is by the sales section of the Act that they are legalised, they should be charged to the sales department accounts. Observations on this report of the district auditor from the secretary and accountant of the electricity supply department and the borough accountant were received and approved of by the Finance Committee, who submitted same for the approval of the Council. After a long discussion, the motion by Councillor Lewis to refer the matter back for reconsideration was lost, and the report was adopted.

Poplar.—The Electricity Committee has decided to renew the tenancy of the Council's electric showrooms and offices at 121, East India Dock Road, as it is satisfied that the showrooms have been profitable, and are of advantage in extending the business of the undertaking. A pump house is to be constructed in connection with the installation of pumps for pumping water for condensing purposes at the generating station, at an estimated cost of £750.

Stepney.—A loan of £2,500 is to be taken up from the L.C.C., for the purchase of meters. The Electricity Supply Committee reports that in connection with the agreement between Stepney and Poplar under which each authority, if required, takes or gives each other a stand-by, bulk, or reciprocal supply of current, that it had under consideration the question of the Council further availing itself of the provisions of this enactment in relation to the question of the provision by the Council and the Poplar Council of machinery and its utilisation to the best and most economical advantage of each Council. After exchanging views with regard to the question it was proposed: (*a*) That the existing agreement should be incorporated in the new agreement; and (*b*) That such new agreement should make provision under which, broadly speaking, the Poplar Borough Council will remove the necessity of the Stepney Borough Council providing certain additional machinery until such time as the maximum demand of Stepney reaches 7,270 kw., by affording the Stepney B.C. a supply of electricity and by the Stepney B.C. themselves, after this period of supply, affording to the Poplar B.C. a supply. Subject to details being satisfactorily settled and to the approval of the B. of T. and the L.C.C., the Committee has decided to enter into the proposed agreement, and to fix the seal of the Council thereto when ready. Closely associated with this agreement, the Committee states, is the question of the Council's own position at the present moment as electricity supply undertakers, and the question was particularly accentuated by the remarkable increase in the growth and development of the undertaking, which necessitated the immediate consideration of the provision of further machinery. In this connection it had considered a report by the electrical engineer and manager to the effect that the two double-current turbine-driven sets at the Limehouse station should be converted into alternators, and that two 1,000-kw. converters should be provided therefor. With this object in view, he had obtained the following quotations for carrying out the work:—Conversion of double-current generators to two 1,500-kw. alternators, B. Peebles & Co., £3,784; Siemens Bros. Dynamo Works, £3,787; Dick, Kerr & Co., £3,936; C. A. Parsons & Co., £4,473; two converters required in connection therewith, B. Peebles & Co., £4,600. The above offers do not include the cost of alterations to, and the preparation of, concrete foundations and sundry adjustments necessary to the two turbines. Having considered the foregoing proposals, the Committee have decided to accept both the offers of Bruce Peebles & Co. at £3,784 and £4,600 respectively.

Hammersmith.—Subject to a satisfactory agreement being entered into with the Kensington and Notting Hill Electric Lighting Companies for the supply to the Council of additional three-phase current, it has been decided to agree to supply three-phase current to the Shepherd's Bush Exhibition at the rates of 1d. per unit from sunrise to sunset, and 2d. per unit from sunset to sunrise, plus an additional 1d. per unit for the first 50,000 units per month, and for all the three-phase current supplied after October 15th and otherwise, upon the terms and conditions of the existing agreement for the supply of current from the Council. A supply of current is also to be given the Brilliant Sign Co. for a period of 7 years subject to an agreement being entered into that the whole of the firm's machinery should be driven by electric power, and to the payment of the minimum sum of £300 during the first three years. Subject to the payment of a royalty of 10s. 6d. per stand and without prejudice to the rights of the Council under their contract for the supply of electricity to Olympia, certain exhibitors at the International Machinery Exhibition to be held there in October next are to be granted permission to install small motor plant for generating current for the purposes of demonstration on their respective stalls.

L.C.C.—It is proposed that a Special Committee on London Electricity Supply be appointed, constituted as follows:—Sir John Benn, Messrs. H. E. A. Cotton, H. H. Gordon, Frederick Hall, Percy A. Harris, Bernard Holland, G. H. Hume, Isidore Salmon, Stuart Sankey, A. J. Shepheard, W. J. Squires and W. Whitaker Thompson. The terms of reference to the Committee include the power to confer with such Government departments as it thinks necessary, and with the local authorities and companies generating or supplying electric current in London. It may also obtain such expert advice as may be necessary; but prior to becoming committed to any proposal affecting the Council's position as a loan sanctioning authority, the Finance Committee must be consulted.

The St. James's and Pall Mall Electric Light Co. has decided to discard some of its old plant at the Carnaby Street works, and re-equip it as a transformer sub-station with a reserve battery.

Pelton.—The P.C. has decided to ask the Electric Lighting Co. to submit a tender for the lighting of the district.

Pontefract.—Objections to the application of the T.C. for a prov. order for E.L. have been made by the Locomotive Manufacturers' Association and Railway Carriage and Waggon Builders' Association, the Yorkshire Electric Power Co., the Electrical Distribution of Yorkshire, Ltd., and the Electrical Contractors' Association (Incorporated). The opposition threatened by the West Riding C.C. has been withdrawn.

Radcliffe.—An inquiry was held on February 14th and 15th by Mr. T. C. Elkin, on behalf of the L.G.B., respecting the U.D.C.'s application for sanction to borrow £17,000 on behalf of the electricity undertaking. The scheme provides for the extension of its own electricity works by the addition of new plant, and the transmission of a bulk supply from the new municipal generating works erected by the Bury Corporation at Chamber Hall. Two-thirds of the proposed expenditure will be incurred by the apparatus for taking and distributing the supply from Bury. The inquiry was invested with interest by reason of the opposition to the Council's scheme by the Lancashire Electric Power Co., who desire to break down the municipal monopoly in the town. The Power Co.'s works are on the borders of the township, and its case is that the town ought to avail itself of the facilities afforded by the near existence of the generating station, while counsel for the company also pointed out there were ratepayers who objected to the Council's expenditure as being needless, because there was an adequate supply there already. The Power Co. is applying to Parliament for a provisional order to enter Radcliffe (as it did without success two years ago), and counsel for the Council contended that if the B. of T. decided to grant the company's application, all municipal Lancashire would be up in arms and would call upon Parliament to reject it. Mr. S. J. Watson, the Bury Corporation's electrical engineer, giving evidence, pointed out that the Bury works had not to pay an expensive board of directors and maintain London and Manchester offices like a private company had. Mr. E. M. Lacy, consulting engineer to the Radcliffe U.D.C., said that, taking everything into consideration, the terms offered to Radcliffe by Bury were better than those quoted by the Power Co. The Inspector refused an application by the Power Co. for the production of the agreement between Bury and Radcliffe. Counsel for the company hoped that the L.G.B. would insist on the agreement being sent for its perusal.

Rawtenstall.—The T.C. has adopted plans for extensions to the electricity works, at an estimated cost of £1,500.

Richmond (Surrey).—The T.C. has agreed to a proposal which permits of the Electric Lighting Co. taking a supply in bulk from the Lot's Road or other big generating plant. Various reductions in price are to be made in connection with this arrangement, which will also result in the removal of all steam generating plant from the local station eventually. The period of compulsory purchase by the T.C. will be extended to 1921, and provision is made for revision of prices at five-year intervals.

Rochdale.—On Tuesday Mr. T. C. Elkin held a L.G.B. inquiry into the application of the T.C. for sanction to a loan of £8,700 for extensions to buildings and plant at the Dane Street electricity works; the amounts set down were £1,200 for a chimney stack, £1,300 for engine-house extensions and switchboard galleries; £1,200 for economiser house, &c.; £650 for economiser, £2,650 for Lancashire boilers, £1,000 for a motor-alternator, and £700 for switchgear. There was no opposition to the loan.

The electrical engineer has intimated to the Electricity Committee that the responsibilities undertaken by that department would necessitate a further loan of £4,000 in addition to the £8,700 mentioned above. The latest additions to plant, &c., now proposed are due to the Whitworth and Milnrow tramway extensions and to the decision of the Council to widen the area in which it is proposed to supply in bulk. The extensions are expected to be required by the end of the present year.

Salford.—A number of the employés in the Corporation electricity department, along with workers in the lighting, gas and sanitary departments, came out on strike on Monday morning. The men ask for improved working conditions, including an increased wage minimum. On Monday night hundreds of strikers collected outside the electricity works with a view to persuading the men who had not joined their ranks to do so, and in many cases they were successful. Fears are entertained that the trouble may spread to the tramcar drivers and conductors. At a meeting at midnight, tramcar drivers and conductors were urged to join the strikers, but they declined to give a decision till they had consulted their secretary, Alderman Jackson. The greatest number of malcontents belong to the gas department. Half the streets of Salford were in complete darkness on Monday night.

Scarborough.—The Electric Supply Co. has just built a large coal store, and made provision by that means for five or six weeks' supply, over and above the ordinary supply, under contract. There will be two months' supply of coal to fall back upon in the event of a strike, and the supply of electricity can be maintained certainly for that length of time. Anxiety amongst Scarborough people in regard to the threatened coal strike is rather amusingly indicated in the fact that several nervous consumers called at the

electric supply office and inquired whether it would be advisable to purchase oil lamps. They were assured that the electric supply would be maintained over any probable period of the threatened strike

Stockport.—The Corporation is seeking the consent of Heaton Norris U.D.C. to supply the area which adjoins Stockport with electricity, and the Heaton Norris Ratepayers' Association has written urging the Council to resist any attempt of Stockport in this direction.

Stourport.—The B. of T. has informed the U.D.C. that it intends to revoke the electric light order, as the Kidderminster and District Electric Light Co., which is the undertaker, has found it commercially impossible to tender for the public lighting. Consequently the company did not propose to supply electricity to Stourport, but did not intend to surrender the powers conferred in respect to the Kidderminster foreign district. The U.D.C. has decided to acquiesce in the revocation of the order.

Sunderland.—At a meeting of the T.C. on the 14th inst., Alderman Bruce moved the adoption of the Electricity and Lighting Committee's report, which recommended that additional plant be obtained for the Hylton Road power station, at an estimated cost of £22,207, and that alternating and continuous-current mains be provided, at an estimated cost of £15,000. He said they were asking for a new turbine, and with its assistance would be able to supply new customers, and the resulting revenue, amounting to £1,275, would more than meet the additional interest and sinking fund on the new plant. By means of the new plant they would be able to produce more power at a cheaper rate, while at the same time the present plant would provide them with a means of safety in case of a breakdown. The profits on the electricity works last year were about £5,000, against £1,100 for the year previous. The engineer was strongly in favour of the proposal, and the Committee, with one exception, was in favour of it. Mr. Frank Nicholson said that from 1905 to 1911, inclusive, the capital expenditure had increased by £127,000, or 42 per cent., but the annual amount set aside for sinking fund had increased in the same period from £9,900 to £16,000, or 63 per cent. Alderman Bruce said the critics of the undertaking forgot to deduct from the total of the money borrowed the money that had been paid back. Already, of the £431,000 that had been borrowed, over £117,000 had been paid off. They had not taken a penny out of the rates, so that this sum must have come out of the profits. After further discussion, the report was carried.

Swinton and Pendlebury.—Before entering into a fresh agreement with the Lancashire Electric Power Co. for the supply of electricity in bulk, the Swinton and Pendlebury D.C. has called in, as consulting electrical engineer, Mr. R. B. Leach.

Taunton.—The T.C. has lodged a petition against the Bill of the National Electric Construction Co., Ltd., which seeks to confirm free wiring agreements with the Corporation and other Councils, the agreements entered into having been proved to be *ultra vires*. Not wishing to entirely repudiate the agreement, the Council unsuccessfully tried to compromise with the company.

Torquay.—The T.C. has instructed the engineer to submit a scheme for supplying electricity to St. Marychurch.

Walkden.—A proposal of the Worsley D.C. to electrically light that portion of Walkden known as the Barracks has been defeated, 9 voting against and 4 in favour of the scheme, which had been sanctioned by the Highways Committee, which had also accepted the tender of the Lancashire Electric Power Co. for poles and electric lighting.

West Bromwich.—The T.C. has applied to the L.G.B. for a loan of £7,700 for electricity extensions. A travelling crane, two boilers, an economiser, feed pump and induced-draught plant are to be installed.

Whitehaven.—The following terms have been adopted by the T.C. for a stand-by supply of current: A fixed yearly charge of £2 per KW., based on the maximum number of kilowatts required, in addition to the ordinary supply rates and usual meter or other rents, with six months' notice on either side to terminate agreements.

Wigan.—The extensions and new equipment just completed in connection with the Municipal Electricity Works, were formally opened on Wednesday afternoon last week, when a new 1,000-KW. mixed-pressure turbine set and a 400-KW. reciprocating set were started up.

Worcester.—The T.C. has petitioned against the Bill of the London and North-Western Railway Co. seeking powers for railway companies to supply current to works, &c., adjoining their lines.

TRAMWAY and RAILWAY NOTES.

Belfast.—A prolonged chapter in the municipal history of Belfast was closed on 14th inst., when the Corporation sanctioned the payment of £56,155 (the amount of the arbitrator's second award), to the Cavehill and Whitewell Tramways, as the value of the undertaking as a going concern, that is to say, as a rent or profit producing undertaking. The decision was arrived at at a special meeting of the Corporation, summoned to receive and adopt so much of the minutes of the proceedings of the Law Committee of the 10th inst., as referred to the arbitrator's award in the matter of the tramway. To the price fixed by the arbitrator, some £10,000 additional expenses have been incurred, thanks to the mischievous work of the people, who, in conjunction with the Nationalists and Trade Unionists, made the sale of the system a political one. For this uncalled-for intervention, the taxpayers of Belfast will have to pay £10,000, or one-sixth of the original award for the purchase of the system as a going concern.

A memorial from certain residents of the Botanic Avenue district objecting to the proposed line of tramway on Botanic Avenue has been considered. Mr. Nance reported that the avenue was perfectly safe for a tramway, and that since the memorial had been published in the Press, he had received a large number of letters from residents in the district, asking that the line should be proceeded with. The Committee decided, having regard to the fact that the tramway had been approved of by the Council and sanctioned by Parliament, to go on with the construction of the line on the avenue in question. The proposed extensions will measure about 7 miles.

Colwyn Bay.—It was reported at the meeting of the Council last week that the Llandudno and Colwyn Bay Electric Railway Co. had written declining to comply with the request of the Council for a further payment towards road widening expenses, with a view to the construction of the tramway to Old Colwyn. The Clerk to the Council was instructed to reply expressing the Council's disappointment, and to say that it would not be in a position to make further progress with the negotiations for the purchase of land until the expenses in that respect were met by the company. It was also decided to suspend these negotiations for the time being. Mr. Purdy, replying to statements made at the annual meeting of the Electric Railway Co., denied that the Council was in any way obstructing the scheme for the extension of the tramway to Old Colwyn. The Council was unanimously in favour of the company going on, and was pressing it, in fact, to do so. The one drawback, as far as the Council was concerned, was that the company was trying to get out of its contract to pay the Council £3,000 for the work done to take the line up to Groes. If the Electric Railway Co. allowed its powers to lapse, the Council would in all probability take them up, and make the line itself

Continental Notes.—ITALY.—The Italian Government has just granted a concession to the Société Franco-Italienne du Chemin de Fer Métropolitain de Naples, which is a company formed in Paris chiefly with French capital, for the construction and working of an underground railway network in Naples, the term being for 70 years. The undertaking will comprise a city network and a suburban network which will be connected together in the new city part of Vomero. The former, which will traverse the city from west to east and be nearly five miles in length, will begin near Piedigrotta, and will end at the station of the Vesuvius Railway. In the case of the suburban line, which will partly be worked on the rack-rail system, a commencement will be made at Vomero, and the terminus will be at Agnano, the total length being 6·2 miles. The city line will be provided with 15 stations, which will be equipped with lifts and staircases for reaching the surface, and it is to be completed within five years. It is estimated that the total cost of construction will amount to £1,200,000, and the company will not receive any subsidy either from the Government or the city authorities. The establishment of the railway will permit of the migration to the healthy suburbs of a portion of the population now living in the overcrowded interior of the city.

La Società Trazione e Imprese Elettriche is the name of a new company which has lately been formed in Milan to acquire and carry on the Milan-Gallarate tramway, and to convert the same to electric traction.

The Consiglio dei Ministri have authorised a concession to a private syndicate at Belluno for the construction and working of an electric railway from Belluno to Agordo, with a branch to Roe Basse Bibano. The line is estimated to cost, including rolling stock and working material, 5,685,496 lire. The State accords an annual subsidy of 6,800 lire for 50 years.

The Consiglio have also under consideration two other electric railway concessions, the one for a line to run from Formignie to Mocogno through Lama and the other from Lucca to Pietrasanta *via* Camnione.—*L'Ingegneria Ferroviaria.*

FRANCE.—La Société Nantaise de Tramways et d'Electricité is the name of a new company which has just been formed in Brussels with a capital of £600,000, to acquire and carry on the tramways and electric lighting undertaking in the town of Nantes.

TURKEY.—La Société des Tramways de Salonique has just secured a concession for a new line of electric tramways in the town of Salonica.

Hove.—The T.C. has, by 22 votes to 9, confirmed the propriety of promoting a Bill empowering the Council to run vehicles by means of railless traction.

Hull.—On Monday the Corporation Tramways Committee decided to allocate £12,000 out of the tramway profits towards the relief of the rates.

London.—L.C.C.—It has been decided to allow certain tests to be carried out with the railless trolley system on the route between Woolwich and Eltham.

HAMMERSMITH.—Mr. W. Worby Beaumont, the Referee appointed by the B. of T., will open an inquiry at the Law Courts to settle the difference between the London United Tramways Co. and the B.C. The company's solicitors have served on the Council's

solicitors a writ asking for the appointment to be declared null and void.

Madagascar.—The Consultative Chamber of Fianarantsoa has taken in hand the question of installing a local electric railway between that city, the actual capital of the South, and the port of Mananjary on the East coast. The country offers the greatest facilities for an undertaking of this kind, and it appears possible to form a private company and carry out the scheme, without a subsidy from the colony, the goods traffic in sight being such as to make the venture sufficiently profitable.

Mexico.—The Imperial Trade Correspondent at Toronto reports that a Canadian company has been incorporated, with a capital stock of about £1,027,000, to construct and work an electric railway, 90 miles in length, from Mexico City to Puebla, for which a concession has been obtained from the Mexican Government. In connection with the foregoing, it may be noted that H.M. Consul-General at Mexico City reports that work on the electric lines to connect Mexico City with Puebla and Toluca will probably be begun this year. Extensive surveys have been made, but it has not yet been decided whether the Puebla line shall pass through Xochimiloc or a little to the north and east. A quantity of T rails and trolley wire has been ordered for suburban use, and a large stock of material is in hand. The mule tramway to Santa Fé is to be converted to electric traction as the first link on the road to Toluca.—*Board of Trade Journal.*

Nottingham.—A curious "hold-up" on the tramways occurred on Sunday night. In what is known as the King Street section, and which includes the whole of the lines in the Market Place, Market Street, King Street and Parliament Street, the cars came suddenly to a standstill and the lights were extinguished. After a few minutes' delay the current came on, the cars, again illuminated, responded to the drivers' efforts, and moved forward about a dozen yards, only to come to an abrupt stop with simultaneous extinction of the lights. This alternate coming-on and going-off of the current continued for three-quarters of an hour, and in the meantime the Market Place became congested with between 50 and 60 cars. Every now and then the great six-acre Market Place would be brilliantly illuminated by the electric lights on this great assemblage of cars suddenly glowing, the cars would move forward, and then darkness and stagnation would return. Passengers quitted the cars in scared promptitude and large crowds of people watched the novel scene with wonder and not a little amusement. The first indication of anything wrong occurred at 10 o'clock, and it was not until a quarter to 11 that the current became continuous and the system was working normally.

Oxford.—It is rumoured that the National Electric Construction Co. has proposed that the Corporation should purchase the local tramways and electrically equip them, afterwards leasing them to the company, who will pay the financial charges incurred. The Council will shortly consider the proposal, which it is hoped will extricate the Corporation and company from a difficult position.

Plymouth.—The traffic return for the four weeks ended February 10th showed receipts amounting to £2,383, an increase of £70 compared with the corresponding period of last year. There was an increase on all the sections. There was a considerable decrease in the consumption of energy, which averaged 1·37 units per car-mile, as against 1·53 last year.

Stalybridge.—Colonel von Donop, reporting on the tramway accident at Mossley on October 20th, says the driver lost control of his car, either owing to mismanagement, or to a defect in the controller. The evidence was limited, but he favours the latter cause. The Joint Board has arranged to fit all cars used on hilly routes with the Huddersfield form of mechanical brake. The inspector urges that the magnetic brake should be used habitually, and not treated as an emergency brake, in order to make its use familiar.

Tasmania.—According to the *Australian Mining and Engineering Review*, it is the intention of the Government to approach Mr. C. H. Merz on the question of furnishing a report upon the electrification of the Tasmanian railways, and the utilisation of hydro-electric power for the purpose.

Victoria.—Mr. P. J. Pringle, manager of the Electric Supply Co. of Victoria, has forwarded to the directors in England a proposition in connection with the extension of the Ballarat Tramways to Sebastopol.—*Australian Mining and Engineering Review.*

TELEGRAPH and TELEPHONE NOTES.

Canada.—The Bell telephone franchise with the city of Ottawa will terminate in June next, and the city, before renewing the franchise, is taking steps to investigate the working of a municipally-owned telephone system. The citizens claim that the prices of telephones are too high—$25 for residential and $45 for business purposes. At present the bonus paid the city is but $5,000, and there are nearly 9,000 telephones in use, the number having trebled since 1904, when the contract with the Bell Telephone Co. was made.

The people of Manitoba have not made a success of the Government-owned telephone system in that province. The former low rates, given at first by the Government, had to be raised to a paying basis, and now the people are kicking to such an extent at the high telephone rates, that the question has become quite a thorn in the side of the Manitoba Government.

Mexico.—An American Consular report states that a concession has been granted to a number of merchants in Monterey for the operation of a telephone system in that city on a co-operative basis. The plan of the originators of the idea is that each subscriber should own his telephone, and there will be not fewer than 4,000 subscribers who will also be stockholders in the new company.

New Zealand.—Before long Wellington will have a long-distance wireless station of very high power. The station is being erected on the top of Otari Peak, the highest point of the Tinakori range, nearly 1,000 ft. above sea level. The masts, two in number, will be 150 ft. high; they are to be of the ladder type, of wood. When this station is completed it will be possible to "wireless" to Sydney and Fiji, and other distant parts. In the meantime the smaller wireless plant at the G.P.O. is in constant use.

Paris Telephone Service.—The telephone service in Paris has always been a source of great discontent on the part of the subscribers, being a State undertaking, and very slow in operation. But recently a curious state of affairs was reported by the Paris correspondent of the *Standard*, in which the fault lay on the part of the subscribers. It appears that a number of the latter, desirous to prevent disturbance of their slumbers, have been in the habit of taking the receiver off the hook on retiring to rest. But having occasion to use the telephone at night themselves, they find their lines cut off. As the result of the commotion and indignation consequent upon this discovery, the explanation has been afforded that so large a number had adopted the plan described above—which had the effect of keeping their signal lamps in the central-battery exchange alight all night—that the current consumed enormously increased, and to prevent endangering the working of the whole system, it was found necessary to cut off the subscribers in question for the night. They cannot have it both ways—either they must forfeit the use of the telephone at night, to secure freedom from interruption, or they must submit to the risk of being called up, in order to retain their privileges.

Russia.—The Russian Budget Bill for 1912 includes, for the construction and repair of telegraph and telephone lines, a sum of 9,800,000 roubles.—*Board of Trade Journal.*

Telegraphic Addresses.—The Post Office authorities are considering the possibility of hastening the delivery of telegrams to registered addresses in London by including in the address a second short word indicating at once the office from which the telegram will be delivered, and thus saving time. In future telegraphic addresses this object might, we think, be achieved by a special ending to the actual word itself.

The Telephone Factory.—The Town Clerk of Nottingham has received formal acknowledgment of the letter conveying the request of the City Council and other public bodies to the Postmaster-General, that he should receive a deputation on the subject of the proposed removal of the telephone factory from Nottingham to Birmingham. At present it is uncertain whether Mr. Samuel will receive a deputation, inasmuch as he has already intimated to the City Council that his decision involving the change is irrevocable.

The Telephone Service.—In reply to a question in Parliament, the P.M.G. stated recently that the rural telephone party line scheme had failed for want of subscribers, and new conditions would be announced shortly. He stated also that the Government had decided to pay contributions in lieu of rates on premises taken over from the National Telephone Co., on the same basis as in the case of other Government buildings, and on lines acquired from the company in accordance with the assessments as they stood on June 30th last. These assessments would not be increased or decreased as wires were added or removed.

The attack upon the management of the telephone service by the Post Office is being developed, on the one hand by the Telephone Users' Association, and on the other by two committees of members of Parliament, with a view to bringing about improvements in the efficiency of the service.

Telewriter Progress.—It is stated in the Press that a greatly improved pattern of the instrument of the National Telewriter Co. is in use in connection with the Press Gallery of the House of Commons, for the transmission of late messages direct to the composing rooms of three of the leading London daily papers. It is also being tested by the Admiralty with a view to installing it on warships.

Wireless Telegraphy.—The range of the military station on the Eiffel Tower is to be doubled, and plant of six times the present output installed.

CONTRACTS OPEN and CLOSED.

OPEN.

Aberdare.—March 6th. Service materials for the U.D.C. Electricity Department. See "Official Notices" February 16th.

March 11th.—Electrical goods, for the Powell-Duffryn Steam Coal Co., Ltd., 101, Leadenhall Street, London, E.C. (Form 26). Stores Manager, Aberaman Offices, near Aberdare.

Australia.—Victoria.—March 12th. Testing instruments, for the P.M.G.'s Department, Melbourne. See "Official Notices" January 26th.

March 26th.—Dry cells, for the P.M.G.'s Department, Melbourne. See "Official Notices" February 16th.

April 2nd.—250 plugs, three-conductor, for the P.M.G.'s Department, Melbourne. See "Official Notices" to-day.

April 16th.—Magneto table telephones and common battery wall telephones, for the P.M.G.'s Department, Melbourne. See "Official Notices" February 16th.

Western Australia.—April 3rd. Deputy P.M.G. Four steel towers 40 ft. high, and two steel towers 55 ft. high (Schedule No. 180). High Commissioner in London for the Commonwealth of Australia, 72, Victoria Street, S.W.—*Board of Trade Journal.*

Paper-insulated, lead-covered cable and loading devices (Schedules 184 and 185), for the P.M.G.'s Department, Perth. See "Official Notices" to-day.

Belfast.—February 28th. Seven miles of double track permanent way for the Corporation. Mr. H. A. Cutler, city surveyor, (deposit two guineas).

Birmingham.—March 12th. Electrical stores, for a year, for the Birmingham, Tame and Rea District Drainage Board. Mr. J. D. Watson, engineer, Tyburn, Birmingham.

Bolton.—February 26th. Stores and materials for a year, for the Corporation Tramways Department. See "Official Notices" February 9th.

Bournemouth.—February 26th. The Education Committee. Tenders for the wiring of the New Science, Art and Technical Schools and Public Library, Lansdowne. Specifications and forms of tender, £2 2s. (returnable), from the Borough Engineer.

Bradford.—February 29th. Emergency excitation battery, and oil-eliminating plant for feed-water purification, for the Corporation. See "Official Notices" February 16th.

Canada.—March 1st. The Commercial Intelligence Branch of the Board of Trade is in receipt of copies of the plans and specifications and form of tender in connection with a call for tenders for the supply and erection of turbine pumping machinery for the main pumping station at Winnipeg. The pump must be of the best type of horizontal turbine pump driven by an induction motor, directly connected. Tenders to the Mayor and Board of Control, Winnipeg, Manitoba. A deposit of $1,200 (about £247) is required with each tender. The documents referred to may be seen by British manufacturers at the Commercial Intelligence Branch of the Board of Trade, 73, Basinghall Street, London, E.C.

Calgary.—March 20th. City Commissioners. One 2,500-kw. turbo-generator set, one 1,000-kw. synchronous motor-generator, 50-kw. motor-generator and 25-kw. exciter set. Deposit £500. Particulars can be seen at Board of Trade Commercial Intelligence Department in London.

Coventry.—March 11th. Stores for a year, for the Corporation Electricity Department. See "Official Notices" February 16th.

Devonport.—March 7th. Switchboard extension and one 1,000-kw. d.c. turbo-generator, for the Corporation. See "Official Notices" February 16th.

Dover.—March 5th. Electrical sundries, cables, &c., for a year, for the Harbour Board. Mr. Martyn Mowll, Registrar, Castle Street. Schedules 2s. 6d. each.

Dublin.—March 6th. 5,000-volt, 100-kw., three-phase transformer pillars, for the Corporation. See "Official Notices" February 16th.

March 6th.—1,500-kw. polyphase alternator and dismantling and alteration of plant at the Pigeon House generating station, for the Corporation. See "Official Notices" to-day.

Dundee.—The Corporation Tramways Committee invites tenders for stores. Mr. Peter Fisher, manager.

Great Central Railway.—March 5th. Stores and materials for a year. See "Official Notices" to-day.

Heston and Isleworth.—March 5th. Stores for a year, for the U.D.C. Electricity Department. See "Official Notices" February 16th.

Hornsey.—March 4th. Barometric condenser, pumps, pipework, &c., for the T.C. electricity works. See Official Notices" February 16th.

Hoylake and West Kirby.—March 7th. Two centrifugal pumps and a.c. electric motors, frequency 50, with automatic switchgear, for U.D.C. sewage pumping works. Engineer and surveyor, Town Hall, Hoylake.

Hungary.—March 6th. Tenders are being invited by the municipal authorities of Mor (Fejer) for the establishment of a central electric lighting station in the town.

Ilford.—February 27th. Stores for a year, for the U.D.C. electricity works. See "Official Notices" February 9th.

Kirkcaldy.—February 29th. 1,000-kw. steam turbo-generator, with condensing plant and cooling tower, for the Corporation. See "Official Notices" February 9th.

Leeds.—March 9th. 6,000-kw. turbo-alternator, with exciter, condensing plant, piping, &c., for the Corporation. See "Official Notices" February 16th.

London.—Battersea.—March 5th. One 1,500-kw. high-pressure steam turbine coupled to two 750-kw. d.c. generators, with surface condensing plant and pipework, and switchgear, for the B.C. See "Official Notices" February 16th.

Poplar.—March 4th. Telpher coal-handling plant and alterations to existing conveyor at the B.C. electricity works. See "Official Notices" February 16th.

St. Pancras.—March 7th. Arc lamp carbons, for the B.C. See "Official Notices" February 9th.

L.C.C.—March 8th. Electrical installation at the Victoria Embankment Gardens conveniences, Charing Cross. See "Official Notices" to-day.

Marylebone.—March 13th. Materials for a year, for the B.C. Electricity Department. See "Official Notices" to-day.

Manchester.—February 27th. Eight-ton overhead hand-power travelling crane over auxiliaries, operated from floor-level, for the Corporation Electricity Committee. Mr. S. L. Pearce, chief electrical engineer, Dickinson Street (returnable deposit £1 1s.).

Margate.—Two small electrically-driven rotary pumps, with automatic starting and stopping apparatus, for the T.C. Mr. E. A. Borg, surveyor, Grosvenor Place.

Newport (Mon.).—March 5th. Electric light fittings, for the B. of G. Mr. A. H. Rees, Clerk, Queen's Hill.

New Zealand.—March 27th. Public Works Department. Supply to Lytellton, under the Lake Coleridge electric power scheme, of water-wheels, generators, switchboards, transformers, and accessories, also travelling crane. Particulars can be seen at Board of Trade Com. Int. Dept. in London.

Norway.—March 1st and 4th. Christiania Corporation Electric Works. (1) Transformers; (2) low-current cables. Sealed tenders to "Elektricitetsverkets Expeditionskontor, Raadhusgaten 19," Christiania. Local representation is desirable. Copies of the specifications (in Norwegian) and of the form of tender for (2) may be seen at the Commercial Intelligence Branch of the Board of Trade, 73, Basinghall Street, London, E.C.—*Board of Trade Journal.*

March 5th.—Overhead conducting material and hollow steel posts, for the Trondhjem tramway extension. Specification at the Com. Int. Dept. of the Board of Trade in London.

Nottingham.—March 2nd. 350 tons of steel tramway rails and seven tons of tie bars for the Tramways Committee. Mr. A. Brown, city engineer.

Rochdale.—March 6th. Corporation Paving and Sewage Committee. Electrically-driven centrifugal pumping plant, at the Roch Mills Sewage Disposal Works. Specifications and forms of tender (£5, returnable) from Mr. S. S. Platt, borough surveyor, Rochdale. Tenders only considered from firms who have had experience with similar work.

Salford.—March 11th. Stores, &c., for a year, for the Corporation Electricity Department. See "Official Notices" to-day.

Southampton.—Tenders are to be invited for reconstructing the tramway track from Grove Road to the Shirley terminus at an estimated cost of £4,250, also for the supply of rails in connection with the reconstruction works on the Shirley route. Tenders are also to be invited in July next for the reconstruction of the tramway track between the Clock Tower and Bargate at an estimated cost of £3,500.

Siam.—Bangkok.—March 15th. Electric power station with a capacity of 3,000 kw. For further particulars, see this column for November 24th.

Sunderland.—March 5th. Steam turbine, 5,000-kw. alternator and condensing plant, for the Corporation. See "Official Notices" to-day.

Swansea.—March 6th. Turbo-alternators and condensing plant, for the Corporation. See "Official Notices" to-day.

Swindon.—March 9th. Materials for a year, for the Corporation Electricity and Tramways Department. See "Official Notices" to-day.

Taunton.—Single-phase transformers, for the T.C. See Official Notices" to-day.

Walthamstow.—February 23rd. Stores for a year, for the U.D.C. Electricity and Tramways Departments. See "Official Notices" February 2nd.

Warrington.—March 6th. Motors and transformers, for a year, for the Corporation Electricity Department. See "Official Notices" February 16th.

Warlingham.—February 26th. Electric light sundries for a year, for the Croydon Borough Mental Hospital, Warlingham. Clerk of the Hospital.

West Ham.—March 9th. 5,000-KW. two-phase turbo-alternator, with condensing plant and two-phase E.H.T. switchgear, for the Corporation. See "Official Notices" to-day.

Wrexham.—March 15th. Stores, for the Borough Electricity Department. See "Official Notices" February 16th.

CLOSED.

Altrincham.—The Education Committee has accepted the tender of Messrs. Swainson & Co., at £98, for electric fittings for the County High School for Boys.

Ashton-under-Lyne.—The Electricity Committee has accepted the tender of Messrs. Tetlow Bros. for the supply of three boilers.

Bacup.—The T.C. has accepted the tender of Messrs. W. T. Glover & Co., for cables for the supply of current to Stacksteads.

Belgium.—The Belgian Post and Telegraph authorities in Brussels have opened tenders for the supply of a quantity of telephone cable with 20 pairs of conductors. Ten concerns—one Austrian, five German, two Belgian, one French and one British (the British Insulated and Helsby Cables, Ltd.)—competed for the contract, the lowest offer being that of the Kabelfabrik und Draht Industrie Gesellschaft, of Vienna.

Broadstairs.—The U.D.C. has accepted the tender of Messrs. J. Keith & Blackman Co., Ltd., for two motor-driven ventilating fans for lavatories, at £30 10s.

Dundalk.—At the meeting of the Proposals Committee of the Louth County Council, the following tenders were received for the installation of electric light in Dundalk Court House :—

J. Gowdy, Belfast		£77
Dundalk Motor Works (Mr. P. J. Watters)		130
James C. Meldon, Dublin		89
E. Gallagher		91
Gaskin Bros.	(accepted)	90

Frankton (N.Z.).—The Frankton Junction Town Board has accepted the tender of the Brush Electrical Engineering Co. for the equipment of an electric power house. Suction gas plant will be used, with D.C. dynamos and balancer booster sets.

Gibraltar.—The Admiralty has accepted the tender of the Brush Electrical Engineering Co. for an important extension to the power station at H.M. Dockyard, Gibraltar, consisting of D.C. turbo-generating plant, boilers, condensing plant, mechanical stokers, switchboards, crane, &c.

Government Contracts.—The following tenders have been accepted during the past month by the Government Departments named :—

War Office.

Electric cable and wire.—British Insulated and Helsby Cables, Ltd.; Hooper's Telegraph and India-Rubber Works Co., Ltd.; London Electric Wire Co. & Smiths, Ltd.; Midland Electric Wire Co.

India Office: Store Department.

Cable, &c.—C. Macintosh & Co.
Cells, &c.—J. Stone & Co.

Crown Agents for the Colonies.

Telephones.—New Phonopore Telephone Co.

Office of Works.

Generating sets in connection with British Museum extension.—Browett, Lindley & Co.
Ventilating fans for ditto.—Matthews & Yates, Ltd.

General Post Office.

Silence cabinets.—Siemens Bros. & Co., Ltd.
I.R.V. cable.—Johnson & Phillips, Ltd.
Paper-core cable.—Johnson & Phillips, Ltd.; Henley's Telegraph Works Co., Ltd.; Siemens Bros. & Co., Ltd.; British Insulated and Helsby Cables, Ltd.
Dry cells.—Siemens Bros. & Co., Ltd.
Loading coils.—Western Electric Co., Ltd.
Stoneware conduits.—Albion Clay Co., Ltd.
Cable distribution plugs.—Siemens Bros. & Co., Ltd.
Switchboards.—British L. M. Ericsson Manufacturing Co., Ltd.
Telegraph ironwork, cupholders.—F. W. Cotterill, Ltd.
Telephone exchange equipment at Western Exchange, London.—Automatic Telephone Manfg. Co., Ltd.
Ditto at Morley, Leeds.—British Insulated and Helsby Cables, Ltd.

Hornsey.—For the supply of certain electrical plant, the tender of Messrs. Belliss & Morcom, Ltd., at £3,000, has been accepted by the B.C.

Norwich.—The Electricity Committee of the T.C. has accepted the tender of Messrs. Jas. Howden & Co., Glasgow, for a 2,000-KW. turbo-generator with condensing plant, at £7,798.

London.—L.C.C.—The Education Committee received the following tenders for electric lighting at the School of Photo-Engraving and Lithography :—

Tredegar & Co.	(accepted)	£612
Pinching & Walton		684
A. Hawkins & Sons		819
E. Newbald		834
Tilley Bros.		948
G. E. Taylor & Co.		949
W. J. Fryer & Co.		1,135
G. Weston & Sons, Ltd.		1,221
W. H. Gaze & Sons, Ltd.		1,269
E. Lawrance & Sons, Ltd.		1,320

Chief Engineer's estimate, £712.

The Highways Committee has placed an order for 130 tons of side slot rails for Kingsland Road conduit lines with the Frodingham Iron and Steel Co., Ltd., at £11 15s. per ton.

For the supply of pneumatic tools for the third section of the central car-repair depot the following tenders were received :—

Globe Pneumatic Engineering Co., Ltd. (recommended)	£411
Howard Pneumatic Engineering Co., Ltd.	£448 and £361
Consolidated Pneumatic Tool Co., Ltd.	498

Bermondsey.—The tender of the North-Western Electrical Appliances Co. has been accepted by the B.C. for a supply of lowering gear, at £73.

Fulham.—The Electricity and Lighting Committee has recommended the Council to give its approval to the placing of an order for 300 electricity meters with Messrs. Siemens Bros., the hurried acceptance being due to a low price being quoted provided the order was placed by February 13th.

Shoreditch.—The Electricity Committee received tenders from five manufacturers for paper and rubber-insulated, lead-covered, armoured cable. That of Messrs. Siemens Bros. & Co., Ltd., for 9 miles of ·035 in. × ·035 in. × ·022 in. sectional conductors, at £298 per mile; 5 miles of ·0125 in. × ·0125 in. × ·0125 in. circular conductors, at £192 per mile; 1½ miles of ·0125 in. × ·0125 in. twin circular, at £164 per mile; and rubber-insulated ·0125 in. × ·0125 in. twin, at £233 per mile.

The B.C. has accepted the tender of Messrs. Le Grand & Sutcliffe, at £375 10s., for converting the existing steam action of the Deepwell pump at the Hoxton Baths into an electric motor drive.

Stepney.—The following tenders were received for the conversion of double-current generators at Limehouse to two 1,500-KW. alternators :—

Bruce Peebles & Co., Ltd.	(recommended)	£3,784	(To complete by end of August.)
Siemens Bros. Dynamo Works		3,787	(28 weeks + 3 weeks for erection.)
Dick, Kerr & Co., Ltd.		3,936	(7 months + erection.)
C. A. Parsons & Co., Ltd.		4,478	(Running by end of August.)

Two 1,000-KW. converters required in connection therewith :—

Bruce Peebles & Co., Ltd.	(recommended)	£4,600	(To be running by end of August.)

Plymouth.—The Tramways Committee received two quotations for the supply of 100 tons of tramway rails with fish and anchor plates, and has accepted the tender of the Lorain Steel Co., of America, which was the lowest.

Rawtenstall.—The T.C. has accepted the tender of Messrs. Whipp & Bourne for alterations to the electric call bells, &c., throughout the Municipal Offices.

Sunderland.—The T.C. has accepted the following tenders :—

British Insulated and Helsby Cables, Ltd.—440 yards of 7/20, 7/16, 19/17 and 19/15 cable.
Reason Manufacturing Co.—25 10-ampere electrolytic meters.
Dey Time Register, Ltd.—Dey time recorder.
British Westinghouse Electric Manufacturing Co., Ltd.—Three three-phase integrating wattmeters.

Swinton and Pendlebury.—The tender of Messrs. H. E. Buck & Co. for electric wiring in the Town's Yard has been accepted by the D.C.

West Bromwich.—The T.C. has accepted the tender of the British Thomson-Houston Co., Ltd., for a 1,000-KW. turbo-alternator and rotary condenser.

THE ELECTRICAL ENGINEERS
(LONDON DIVISION).

Commanding Officer—Lieut.-Col. H. M. Leaf.

The following orders have been issued for the current week :—

Monday, February 26th.—"A" Company. Technical work, 7 to 8 p.m. Lecture on "Military Telephones," 8 to 9 p.m. Technical work, 9 to 10 p.m.

Tuesday, February 27th.—"B" Company. Technical work, 7 to 8 p.m. Lecture on "Military Telephones," 8 to 9 p.m. Technical work, 9 to 10 p.m.

Thursday, February 29th.—"C" Company. Technical work, 7 to 8 p.m. Lecture on "Military Telephones," 8 to 9 p.m. Technical work, 9 to 10 p.m.

Friday, March 1st.—"D" Company. Technical work, 7 to 8 p.m. Lecture on "Military Telephones," 8 to 9 p.m. Technical work, 9 to 10 p.m.

Saturday, March 2nd.—Mobilization week-end run at Fort Coalhouse. The party will parade at Fenchurch Street Station (L.T. and S. Railway) at 3.10 p.m. Dress: Service dress, putties, greatcoats, belts and haversacks; no arms will be taken.

(Signed) P. H. Campbell, Capt. R.E. and Adjt.,
For Officer commanding L.E.E.

FORTHCOMING EVENTS.

Institution of Electrical Engineers (Manchester Local Section).—Friday, February 23rd. Annual dinner.

Tuesday, February 27th.—At 7.30 p.m. At the University, Manchester. Paper on "High-Tension Porcelain Insulators," by Mr. J. Lustgarten.

Royal Institution.—Friday, February 23rd. At 9 p.m. Discourse on "The Gyrostatic Compass and Practical Applications of Gyrostats," by Mr. G. K. B. Elphinstone.

Saturday, February 24th.—At 3 p.m. Lecture on "Molecular Physics," by Prof. Sir J. J. Thomson. (Lecture I.)

Tuesday, February 27th.—At 3 p.m. Lecture on "Optical Determination of Stress and some Applications to Engineering Problems," by Prof. E. G. Coker (Lecture I).

Saturday, March 2nd.—Lecture on "Molecular Physics," by Prof. Sir J. J. Thomson (Lecture II).

Physical Society.—Friday, February 23rd. At 5 p.m. At the Imperial College of Science, South Kensington. Papers on "A Method of Accurate Comparison of Quantities of Radium," by Prof. E. Rutherford and Mr. Chadwick; "The Absorption of the γ-rays by Gases," by Mr. Chadwick; and "On Wave-form Sifters for Alternating Currents," by Mr. A. Campbell.

North-East Coast Institution of Engineers and Shipbuilders.—Friday, February 23rd. At 7.30 p.m. At the Lit. and Phil. Society, Newcastle. Further discussion on Dr. F. B. Jevons's paper on "Motion and Change," and paper on "Some Considerations on the Choice of Auxiliary Plant for Power Stations," by Mr. A. H. Finch.

Institution of Post Office Electrical Engineers (Metropolitan Centre).—Monday, February 26th. At 6 p.m. At the I.E.E. Paper on "Machine Switching in Telephony," by Mr. B. O. Anson.

Institution of Electrical Engineers (Newcastle Local Section).—Monday, February 26th. At 7 p.m. At the Technical College, Darlington. Paper on "The Electric Driving of Rolling Mills," by Mr. C. A. Ablett.

Electro-Harmonic Society.—Tuesday, February 27th. At 8 p.m. At the Holborn Restaurant. Concert. Ladies' Night. See "Notes" pages.

Institution of Civil Engineers.—Tuesday, February 27th. At 8 p.m. Papers on "Roller and Ball Bearings," and "The Testing of Antifriction Bearing Metals," by Prof. J. Goodman.

Institution of Electrical Engineers (London Students).—Wednesday, February 28th. At 7.45 p.m. Discussion on "Methods of Illumination."

Borough Polytechnic Institute.—Wednesday, February 28th. At 8 p.m. Distribution of prizes and certificates.

Royal Society of Arts.—Wednesday, February 28th. At 8 p.m. Paper on "Education in Science as a Preparation for Industrial Work," by Mr. H. A. Roberts.

Leeds Association of Engineers.—Thursday, February 29th. At 7.30 p.m. At 5, Park Lane, Leeds. Paper on "The Manufacture of Steel Tram Rails," by Mr. A. S. Keith.

Northampton Institute Engineering Society.—Friday, March 1st. Paper on "Some Recent Developments in Electrochemistry," by Mr. E. L. Emtage.

NOTES.

International Electrotechnical Commission.—At the meeting of the I.E.C. held at Turin, in September last, three Special Committees were nominated to continue the study of Nomenclature, Symbols, and the Rating of Electrical Machinery, and to draw up preliminary propositions which will be laid before the various Local Committees with a view to subsequent international agreement. These Special Committees consist of one delegate each from the following countries:—

Nomenclature. (3)

France, Germany, Great Britain.

N.B.—Prof. Larsen is specially invited to attend the Meeting on Nomenclature.

In view of the growing importance of the Spanish language, the Spanish Committee is invited to send a delegate to follow the work on Nomenclature.

Symbols. (9)

Belgium, France, Germany, Great Britain, Holland, Italy, Spain, Switzerland, U.S.A.

Rating of Electrical Machinery. (8)

Belgium, France, Germany, Great Britain, Italy, Sweden, Switzerland, U.S.A.

Arrangements are being made for a meeting of these three Special Committees to be held towards the end of March, and, at the invitation of the French Committee (President M. R. V. Picou), they will take place in Paris. The following is a list of the delegates who will attend:—

Country.	Nomenclature.	Symbols.	Rating.
Belgium ...	—	Prof. E. Gerard	Prof. E. Gerard
France ...	M. E. Brunswick	M. Paul Janet	M. P. Boucherot
Germany...	Dr. E. Budde	Dr. K. Strecker	Herr L. Schüler
Gt. Britain	Dr. Thompson	Mr. L. A. Le Gros	Mr. A. Siemens
Holland ...	—	Dr. M. de Haas	—
Italy ...	—	To be appointed	To be appointed
Spain ...	—	Señor de la Pena	—
Sweden ...	—	—	To be appointed
Switzerland	—	To be appointed	Dr. Wyssling
Utd. States	—	Prof. C. A. Adams and Mr. C. O. Mailloux.	

London Motor-Cars.—For the quarter ended December 31st, the L.C.C. registered 1,619 motor-cars, 312 heavy motor-cars, and 498 motor-cycles. Altogether, the municipality has registered 48,701 motor-cars, 3,379 heavy motor-cars, and 16,874 motor-cycles.—*The Motor.*

Applications for Appointments.—The following letter reached us too late for inclusion in our "Correspondence" columns, but as it would be too late next week, we print it here:—

"I should like to draw attention through the medium of your paper, to the needless trouble and expense which candidates are often put to by the thoughtlessness of some Corporations, when inviting applications for appointments. My case in point is Willesden, the advertisement of which appears in your issue of February 16th. I duly sent for an application form, and after reading it through, I find a footnote as follows:—The applicant may, if he so desires, forward 33 copies of his application and testimonials to the clerk, for distribution amongst the members.

"Now, the trouble and expense of preparing 33 copies of a fairly lengthy application and three testimonials is no small matter, and although an applicant, who is really in earnest, does not mind devoting some hours of his spare time to the task, to do the work decently means a fairly heavy printers' bill. Certainly the sending of these copies is optional, but what chance does the applicant have who neglects to avail himself of this kind permission? Absolutely none.

"Again, members of the Council, if they seriously considered the matter, would, I think, prefer to do without these extra copies.

"Assuming that there are 100 candidates, which is not by any means unusual, what busy man has time to read through 100 applications and testimonials, and give the matter the attention it deserves? It usually means to him so much waste paper. I contend that sending extra copies is an absolute waste of time both to the candidate and the councillor, and unfortunately it is becoming all too common.

"Let one form only be sent by each applicant. These can be gone carefully through by the chairman of the committee and the clerk, and the qualifications and particulars of the candidates tabulated. To eliminate the unsuitable candidates and prepare a short list of those whose qualifications are most suitable is then comparatively simple, and is the only fair way of dealing with the matter.

"I shall submit my application and testimonials for Willesden without sending any copies, and stand or fall by that, and I trust that all applicants will, by following my example, do their share to put down this growing tendency to put candidates to unnecessary trouble and expense.—ANTI-CANVASSER."

Examinations for Electrical Engineers.—In further reference to our leader of last week, "The Engineer in the Mine," it is evident that the Transvaal Government regulations insisting on all machinery in mines being in responsible charge of properly-certificated engineers, have tended materially to improve the status of engineers in that country. The certificates are only issued after a written examination following on a period of practical experience in mines.

Some four years ago a strike of coal miners in New South Wales, and an agitation amongst some of the men to have electrical apparatus removed from a colliery, caused the Government to institute examinations. These have been carried out successfully, and now every one in charge of electrical plant in New South Wales collieries is certificated. The men have regained confidence in electrical gear, and the agitation against it has practically disappeared.

A year ago the Association of Mining Electrical Engineers started examinations for their own members, and about 60 first and second-class certificates were awarded, there being about 75 candidates. For those who had been in charge of electrical plant in mines for many years special service certificates were granted, on the lines of those given to colliery managers when examinations for colliery managership were first instituted.

The Association will again hold examinations on March 16th and 23rd, and with a strong examination board consisting of Messrs. W. Maurice, W. C. Mountain, Prof. W. Robinson, S. C. Wardell, Alex. Anderson, H. J. Fisher, and Prof. W. Thornton as chief examiner, the candidates may be assured that if they are successful, their certificates will carry weight when appointments are being made by mine managers.

We have had an opportunity of looking through the examination papers set last year, and certainly think that they are a fair test of candidates' practical fitness for taking charge of electrical machinery in mines. Before the certificates are actually handed over, however, the successful candidates must show that they have had actual experience in mines, and this ensures that the certificates shall not be made cheap by being won by the candidate who merely crams for the examination, or who may be well up in theory, but lacking in practice.

Many arguments have been advanced for and against examinations, but we think that examinations which are run on the lines adopted by the Association of Mining Electrical Engineers are free from most of the objections urged against them.

The Transvaal Government will not allow any engineer to be employed in a responsible position in a mine until he has obtained a certificate of competency by examination, and in the case of electrical machinery the certificate must be specially endorsed to the effect that the holder is competent as regards electric power applications.

(!).—At Chorley Police Court on February 15th, Henry Chidlow, of Coppull, was fined 10s. and costs for a breach of the Coal Mines Act. He was found lying on the electric motor in the pump house, asleep, with his arms around the cable. His hand was only a few inches from a belt travelling at the rate of 2,500 ft. a minute. He was supposed to be looking after the motor.

The Civil Engineers' Appointments Board.—At the request of the Council of the Institution of Civil Engineers—Sir Alexander Binnie, Sir Alexander Kennedy, F.R.S., Lord Cowdray and Dr. J. H. T. Tudsbery—have undertaken to form an organisation to assist engineers, especially those of junior rank, to enter into communication with employers who are in need of the services of qualified engineering assistants. The board formed with this object will be prepared to receive applications for engineering employment, and also applications from employers for engineering assistants, and will endeavour to further the interests of both parties by placing them in communication in circumstances which may seem likely to lead to satisfactory results.

It appears to be impracticable for this business to be dealt with otherwise than by letter. Those who seek employment will be furnished with forms in which to state particulars necessary to enable a judgment to be formed as to suitable quarters in which they may be advised to make inquiry. It is not intended to deal with testimonials, which should not be sent to the board unless asked for, but to leave such details of special qualifications to be stated by the applicants individually to those with whom they may be put into communication.

As the undertaking must be self-supporting, it will be necessary to charge some small fees to those who make use of it, and these will be indicated on the forms. Members of the Institution of Civil Engineers especially are invited by the board to assist their endeavour by communicating with them at 3, Little George Street, Westminster, S.W., when they are in need of assistants.

The Electrical Trades Benevolent Institution: Annual Dinner.—Mr. F. B. O. Hawes, the secretary, announces that the Annual Festival Dinner of this Institution, will be held on Friday, April 26th, at the Whitehall Rooms, Hotel Metropole. It is expected that a very distinguished member of the electrical profession will preside. In every way last year's festival dinner was a very great success, and it is to be hoped that, by giving somewhat longer notice of this year's function, still better results may be achieved. The necessity of building up a large invested fund, out of the dividends on which pensions may be paid, is of vital importance.

Fatalities. — A verdict of "Accidental Death" was returned at an inquest at Leigh, Lancs., on the 14th inst., on Wm. Aldred (44), who had been employed at Leigh Gasworks. Deceased was lifting a lid off a purifier by an electric overhead crane, when a spark ignited some escaped gas and set fire to his clothes. He received fatal burns. John Hardman, yard foreman, said some gas always escaped from the purifiers when the lid was lifted. Jas. Gibson, the gasworks manager, said the gas generally got away with the current of air. The reason for the purifier being enclosed was to prevent the fumes going into the neighbouring houses. Arthur Smith, electrical engineer, said a break in the circuit might account for the spark. It was rather dangerous to have such an installation in an inflammable atmosphere.

On Wednesday, last week, an inquest was held on the body of Edward Batchelor (33), lately of Tysoe Street, Clerkenwell, who had wandered on the line at the Cannon Street Underground Station. A doctor said there was a mark of singeing, about 5 in. long, on the neck, a mark on the chin, and the hair had also been burned. Death was due to asphyxia from electric shock. Witness thought deceased might have trodden on the "live rail." Had Batchelor been wearing woollen socks he might have had a better chance, as dry clothing was a non-conductor.

Institution and Lecture Notes.—Institution of Electrical Engineers (Yorkshire Local Section).—The annual dinner of this section was held at the Hotel Metropole, Leeds, on Friday evening last, with Mr. T. Harding Churton in the chair. It commenced at a somewhat early hour, which was fortunate, in view of the very extensive toast list which followed later. As to the latter, we pass over the loyal toasts which, of course, were duly honoured, also that of the "City and Corporation of Leeds," proposed by Mr. J. F. C. Snell, and responded to by the Lord Mayor.

"The Institution of Electrical Engineers" was proposed by Mr. Robert Armitage, M.P., chairman of the Leeds Electricity Committee, who eulogised the work of the Institution, remarking on the extraordinary progress made in electrical matters in a short time, and the great importance of central station supply. Mr. Robert Hammond, in responding, remarked that the I.E.E. was founded almost exactly 40 years ago, and to-day no science was so fraught with influence on mankind as electricity. It had conquered space and time, and provided a system of locomotion, both luxurious and cheap, which its forbears could hardly have dreamt of. The Institution had started on a career of work greater than any in the past—the prolongation of the industrial life of the nation, which depended on the economy of our fuel resources, and an understanding of the great fuel waste involved under present conditions.

The toast of the "Yorkshire Local Section," which followed, was proposed by Ald. Smithson, in the unavoidable absence of Mr. William Cramp; he attributed the growth of the Institution to the success of the local sections, which appealed to the country member, and congratulated Mr. Dickinson (the hon. secretary of Yorkshire Local Section) on his election to the Council of the Institution. Mr. T. Harding Churton, chairman of the Section, in responding, said its progress was largely due to Mr. Dickinson's efforts. It was hoped that the new rules would widen the scope of the Institution, and lead to many allied engineers joining it. A sign of the times was that Leeds was proposing to install a 6,000-8,000-kw. turbine set, which would be one of the largest in the country. He urged strongly that the cost of electricity in Leeds should be reduced to such a level as would induce local manufacturers to give it the preference, rather than that profits should be earned to subsidise the rates.

To Mr. John McLaren fell the task of proposing "The Electrical Industry," which he said had so much vitality that it did not stand in need of boosting up. It had had great obstacles to overcome, thanks to the opposing influence of the Government in the beginning, and unwise speculation. Only the force of necessity gave it its chance, and we were still bound to admit that it did not give an adequate return for the capital and energy expended on its behalf. He agreed with the previous speaker as to the necessity of cheap local power, and urged that a limit should be set to rate appropriations, which were the outcome of a short-sighted policy. A glance at the toast list led him to fear that he would be there till 6 o'clock in the morning, but thanks to the restraint which had been exercised, "we were getting on very well." Mr. Walter Emmott, who briefly responded, deplored the increasing importation of electrical material, which could be produced in Britain.

Mr. George Wilkinson, President, I.M.E.A., proposed the "Kindred Associations," referring to the untimely end of the Consulting Engineers' Association at the hands of its big brother, and Mr. E. Kitson Clarke, who replied, suggested that one would like to hear more of mutual aid amongst engineers as well as the promotion of common interests, to which engineering societies devoted their energies.

The final toast of "Our Guests" was proposed by Mr. Wilson Hartnell, who declared that the engineering prosperity of the country was due to the courage and ability of its commercial men and operating engineers, and deplored the lack of sympathy with engineering developments, especially if they were not immediately successful. Mr. J. S. R. Phillips (of the *Yorkshire Post*) who responded, suggested that had the newspaper press been in existence in early times, engineering and other matters would have progressed much more quickly. In connection with a recent political speech in Ireland, of which everybody knew, he had tested the utility of the electrophone, and it might be news to them that after the first ten minutes or so during which it was possible to hear satisfactorily, that speech was transmitted over the telephone and written out as received.

Musical and vocal selections were rendered during the evening, which, it is unnecessary to add, was fully occupied.

Junior Institution of Engineers.—The annual dinner of this Institution took place at the Hotel Cecil on Saturday last, and was well attended. Commendatore G. Marconi occupied the chair, and amongst those present were Vice-Admiral Sir Henry Jackson, Engineer Vice-Admiral Sir Henry Oram, Sir George Greenhill, and Count Albiz (managing director of the Spanish Marconi Telegraph Co.).

The loyal toasts included that of "The King of Italy," in honour of the President, and were followed by that of "Electrical Intercommunication," proposed by Prof. Perry. He spoke of the rapid progress made in the development of wireless working and of the improvements which had recently been made in cable telegraphy also, and instanced, in regard to the latter, a cable now working between the Azores and America, on which it was possible to transmit 220 letters per minute in each direction. In telephony, too, recent progress seemed to indicate that the possible distance of transmission would be increased by 75 per cent., and he foresaw that in a few years the inhabitants of Teheran, Persia, would be able to listen to opera performed in London.

In reply, the president said that since his first paper was read before the Institution of Electrical Engineers (13 years ago) wireless communication had made great progress. The problem of high-speed apparatus was principally a mechanical one, and in regard to distance of transmission, there need be no limit to its extent in the future. Troubles due to atmospherics were being gradually overcome, receivers were being improved, and the transmitting apparatus was becoming more efficient. In the tropics communication was often effected over 1,000 miles overland. The question of interference was of importance, and the extension of wireless working was largely dependent on the ease with which stations could be operated without mutual disturbance. Vessels only 8 miles from the trans-Atlantic stations at Clifden and Glace Bay were not affected by these larger installations, and the efficiency of stations close together was being greatly improved. With regard to ship working, which was at present limited to the use of two wave-lengths only, he thought a third and longer wave-length should be authorised. Although the number of vessels equipped with wireless apparatus was rapidly increasing, the difficulties due to interference did not increase to a corresponding extent. Much was being done in solving the problem by the introduction of wave-group tuning systems in transmission and also by the development of directive systems. In the latter case, although some spreading of the waves took place, it was relatively small. They did not go all round, and become a nuisance to those who did not want them.

The toast of "The Junior Institution of Engineers" was submitted by Mr. G. C. Horsley, and responded to by the chairman of the Institution, Mr. Walter T. Dunn; and later that of "The President," given by Mr S. Bylander, was enthusiastically received.

During the evening the late secretary of the Institution, Mr. Walter T. Dunn, was presented with an illuminated address and a cheque in recognition of his 27 years' service in that capacity. In making the presentation, Mr. B. E. Dunbar Kilburn referred to the unfailing tact and courtesy shown by Mr. Dunn and to the efficient way in which his work had been carried out.

The musical arrangements for the evening were under the direction of Mr. Richard Cooper, A.R.C.O., and were of a very enjoyable character

Physical Society.—At the annual general meeting on February 9th, Prof. H. L. Callendar, F.R.S., President, in the chair, the reports of the Council and the treasurer were adopted by the meeting. Prof. H. Nagaoka was elected as an honorary fellow.

The officers elected for the ensuing year were as follows:—President, Prof. A. Schuster. Vice-Presidents: those who have filled the office of president, together with Mr. A. Campbell, Prof. C. H. Lees, Prof. T. Mather, Dr. A. Russell. Secretaries: Messrs. W. R. Cooper, 82, Victoria Street, S.W.; and S. W. J. Smith, Imperial College of Science and Technology, South Kensington. Foreign secretary: Prof. S. P. Thompson. Treasurer: Mr. W. Duddell.

Prof. A. Schuster then delivered the presidential address on "A Critical Examination of the Possible Causes of Terrestial Magnetism." He said that scientific opinion had always favoured the view that there was a definite reason for the close approach of the magnetic to the geographical pole. The view that iron was responsible for the observed magnetic field had generally been put aside, because iron lost its magnetisation at temperatures lower than those which must hold at moderate depths below the surface. But the objection raised on this ground disregarded the possibility that the critical temperature of iron might be raised by pressure. For the present they must keep their minds open to the possibility that the iron contained in the earth was magnetisable. The difficulties which stood in the way of basing terrestrial magnetism on electric currents inside the earth were insurmountable. The question whether the rotation of the earth might be responsible for its magnetic field was examined, and the possibility was considered that rotation determined magnetic force which might or might not cause magnetisation according to the nature of the body. This view deserved attention, because there was some theoretical foundation for it, inasmuch as molecules might be considered to behave in a manner analogous to that of a gyrostatic compass. The theory would also explain in a natural manner the secular variation by a precessional motion of a magnetic molecule. On the other hand, the theory would have to explain why the iron inside the earth became—by rotation—more strongly magnetised than the iron in laboratories. There was always the possibility of some substance being subject to the effects of rotation in a much higher degree than iron. Such questions could only be settled by experiments which were in progress. In conclusion, the question was raised whether the negative electron was subject to gravitation.

S.A. Institute of Electrical Engineers.—At the annual meeting on January 18th, at which Mr. J. H. Rider presided, it was stated that there had been a net increase of 65 members, making a total of 270. A students' section had been inaugurated. Mr. W. H. Perrow was awarded the gold medal of the Institute, for the best paper read in 1910. Mr. J. H. Rider was re-elected President, and gave an illustrated lecture on the electrical system of the L.C.C. tramways.

The Polytechnic, Regent Street, W.—A special course of 12 lectures on "Electric Lighting" is being delivered on Thursdays, at 8.30 p.m. The first of the lectures was delivered on January 18th, and the course has been specially prepared for architects, builders, &c. The ground being covered is as follows:—Definitions of circuits; lamps and fittings; wiring and installation work; motors—direct and alterating; generation and miscellaneous.

Association of Mining Electrical Engineers (Newcastle Branch).—On Wednesday the following papers were to be discussed at the meeting of this Section held at Armstrong College:—"Earthing, Earth-Plates and Leakage Detectors," by Chris. Jones (South Wales Branch): "Electricity Applied to the Scottish Shale Oil Industry," by Jas. R. Laird (West Scotland Branch): "Motor Starters for Mining Work," by A. P. Drake, B.Sc. (Yorkshire Branch).

Illuminating Engineering Society.—The annual dinner took place on February 15th. Prof. S. P. Thompson presided, and in responding to the toast of the Society, said it had stimulated invention on the part of some of the members. The Society had been successful in directing attention to such important matters as the proper lighting of schools, streets, shops and picture galleries.

The Imperial Mission is holding a public meeting at the Caxton Hall on Wednesday, February 28th, at 8.30 p.m., at which Mr. Charles Bright, F.R.S.E., will give an address on "Inter-Imperial Cable Communications: a Non-Party Question."

Tungsten Lamp Tests.—The German Gasgluhlicht A.-G. (Auergesellshaft) has had tests made in the Physikalisch-Technische Reichsanstalt, of the duration of life of eight 16-hefner 220-volt metal-filament lamps, with alternating current. The working pressure was 217 volts; the consumption of current at the beginning of the measurements between 0·0944 and 0·0971 amp.; the mean luminosity, measured vertically on the lamp axis, between 16·2 and 17·2 hefners. The specific consumption worked out at from 1·22 to 1·28 watt-hefner. Of the eight lamps tested, seven burned for over 1,500 hours and gave the following measurements:—Current consumption, 0·0941 to 0·0958 amp.; mean luminosity, 15·1 to 16·6 hefners: specific consumption, 1·33 to 1·35 watt-hefner. As a result of the tests it appeared that the falling off in the light in the 1,500 working hours was on the average only 7 per cent.—*E.T.Z.*

Appointments Vacant.—Junior assistant engineers, for the Newcastle-on-Tyne Electric Supply Co., Ltd. (10s.); electrical fitters for H.M. Dockyard, Devonport (36s.); fitter, for the Blackpool Tower Co., Ltd.; charge engineer, for the Corporation Electricity Works, Crewe (£80); charge engineer, for the Greenock Corporation Electricity Department (42s. 6d.); shift engineer, for the Electric Light Department, Southern Nigeria (£300); charge engineer (85s.) and junior (15s.) for the Willesden U.D.C. Electricity Department. See our advertisement columns to-day.

The Electro-Harmonic Society.—The next Concert (Ladies' Night) will be held at the Holborn Restaurant (King's Hall) on Tuesday evening, February 27th, at 8 o'clock. Mr. S. Z. de Ferranti will be in the chair. The artistes are as follows:—Vocalists—Miss Florence Holderness (Soprano), Miss Mabel Braine (Contralto), Mr. Henry Turnpenney (Tenor), Mr. Ivor Foster (Bass-Baritone). Harp, Miss Gwendolen Mason; Raconteuse, Miss Lillian Lyn; Violin, Mr. T. E. Gatehouse; Prestidigitateur, Mr. Bradley Alexander; Sketch at piano, Mr. Ernest Hastings; Humorous sketch, Mr. Fred Curtis; Solo pianoforte and accompanist, Mr. Bernard Flanders, A.R.A.M.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the Electrical Review *posted as to their movements.*

Central Station Officials.—At a meeting of the Dundee Electricity Committee held last week, Convener Nairn moved that the salary of the engineer be increased from £600 to £650. The convener stated that it had been his intention to move an increase of £100, but Mr. Richardson said he would rather have an increase of £50 granted unanimously, than £100 granted only by some of the members. The convener said that their engineer was the lowest paid engineer of any city or town of the size of Dundee. The increase was agreed to.

There was an interesting ceremony at Blackpool electricity works on February 15th, when Mr. C. Furness, the borough tramway manager and electrical engineer, on behalf of the staff, presented to Mr. Geo. Ollier a silver-mounted salad bowl and fruit jar. Mr. Ollier, one of the assistant engineers, is leaving to take up the position of assistant engineer at the newly erected generating station of Bispham-with-Norbreck U.D.C.

Mr. Goulburn, engineer in charge with the Charing Cross, West End and City Electricity Supply Co., Ltd., was presented on Friday last with a slide rule by the members of the engine-room staff, as a token of respect and appreciation. Mr. Goulburn is leaving the company to take up a post in South America.

Mr. H. Collings Bishop, borough electrical engineer and tramways manager at Newport (Mon.), who is relinquishing the position at the end of February, was on Saturday presented by the engineering and clerical staff with a pair of candelabra, a box of cigars and a box of cigarettes.

The Buxton U.D.C. has agreed to allow Mr. Leeming to act as electrical consulting engineer for the County Education Committee, to superintend the E.L. installation at the Cavendish High School for Girls.

On leaving to take up an appointment at Dover, Mr. W. G. Davies, of the Wrexham Corporation electricity staff, has been presented with a dressing case, umbrella, and a case of pipes.

By 15 votes to 5, the Plymouth T.C. has rejected the recommendation of the Electricity and Street Lighting Committee to increase the salary of Mr. F. Hayes, assistant electrical engineer, from £225 to £250 per annum.

The West Bromwich T.C. has decided to increase the salary of Mr. W. A. Jackson, electrical engineer, from £350 to £400 per annum.

Mr. C. Harcourt Stephens has resigned his position as electrical and mechanical engineer to the Cornwall Tailings Co., Ltd., in order to take up the position of engineer at the electrical power station, Raub, Pahang, Federated Malay States.

Mr. R. Brooks, chief consumers' clerk at Marylebone, is leaving to take up an appointment with the Victoria Falls and Transvaal Power Co., Ltd., in South Africa, and his colleagues on the staff were to entertain him at dinner at the Boulogne Restaurant last night. Mr. E. J. Jennings, secretary and accountant of the department, was to preside, and Mr. Brooks was to be presented with a gold watch and an illuminated address. A musical programme, under the direction of Mr. C. G. Adams, was to follow.

Tramway Officials.—The L.C.C. Highways Committee, finding it necessary, owing to the expansion of work in the tramway department, to employ five additional third-class assistants, recommends the promotion of the following from the fourth to the third class (commencing at £160 per annum):—Messrs. G. Brooks, A. E. Planner, H. T. Hider, E. H. Budd and J. Bethune. The following alterations in salaries of staff in the tramway department are recommended:—

Mr. H. D. Smith, advertising assistant, to advance from £525 to £550 per annum.

Mr. H. R. Saxty, building superintendent, to advance from £325 to £350 per annum.

Mr. G. T. Dickins, stores superintendent, to advance from £325 to £350 per annum.

Mr. J. R. Walker, senior charge engineer at the Greenwich generating station, to advance from £300, by increments of £15, to £345.

Mr. J. P. Dudin, charge engineer at the Greenwich generating station, to advance from £270, by annual increments of £10, to £300.

The Secretary for India, in a letter to the Lord Mayor of Liverpool, has asked that the services of Mr. J. A. Brodie (city engineer) may be lent to the Government of India, to advise it as to the laying out of the new capital at Delhi, and a special Council meeting has been called to approve the Health Committee's recommendation that this request be acceded to. Mr. J. A. Brodie has been the city engineer since 1898, and has taken entire control of the construction of the permanent way and equipment of the electric tramways, comprising a length of more than 100 miles; also the erection of five car-sheds: the electrical overhead equipment and cars being constructed under the associated supervision of himself and the city electrical engineer (Mr. A. Bromley Holmes) as joint engineers.

General.—The L.C.C. Education Committee reports that the head of the Physics and Electrical Engineering Department at the Hackney Institute has resigned his appointment, and pending the filling of the vacancy, it recommends the employment temporarily of Lieut. R. F. Pitcairn, R.N. (retired) as lecturer on electrical engineering for four weeks at the rate of £20 per month.

The following notice appears in the *London Gazette* for February 20th: "The King has been pleased to give and grant unto Francis Blewett Shaw, Esq., Electrical Engineer to the Ministry of Local Government in Bangkok, His Majesty's Royal licence and authority to accept and wear the Insignia of the Fourth Class of the Order of the White Elephant, which decoration has been conferred upon him by His Majesty the King of Siam, in recognition of valuable services rendered by him."

Mr. Frank Risch is vacating the position of sales representative for Messrs. Ferranti, Ltd., in London and southern area, in order to take up the post of London sales manager to the Edison & Swan United Electric Light Co., Ltd. Mr. Risch formerly held positions as London manager to Messrs. Kelvin & James White, Ltd., and manager of the sales department of Messrs. Dick, Kerr & Co., Ltd. Trained at the Woolwich works of Messrs. Siemens Bros. & Co., Ltd., he for eight years held a position on the staff of that firm prior to the removal to Stafford, and he was associated with the erection of plants in some of the earliest central stations in London and in the provinces.

Obituary.—The death occurred recently of M. Louis Delaunay-Belleville, of Belleville boiler fame.

We much regret to have to record the death of Mr. Isaac Probert, late superintending engineer of the Postal Telegraph Department. Mr. Probert, who was born in June, 1850, entered the service of the Electric Telegraph Co. in 1864, and was appointed clerk at the Shrewsbury Office in 1869. In 1872 he became assistant instructor at the Telegraph School, then located at Cannon Street, London. In 1889 he was appointed to the important position of electric lighting superintendent, and in 1908 he became superintending engineer in charge of the Postal Electric Light and Power Station at Southwark. Mr. Probert (who retired in June, 1910) during his long career, rendered valuable service to the department, and his loss will be deeply regretted by his numerous friends and old colleagues.

NEW COMPANIES REGISTERED.

Wilkeson Fuel, Light and Power Co., Ltd. (120,329).—Registered February 17th, by Ashurst, Morris, Crisp & Co., 17, Throgmorton Avenue, E.C. Capital, £100,000 in £1 shares. Objects: To carry on in the United States of America or elsewhere the business of colliery proprietors, iron and coal masters, iron and steel manufacturers, miners, smelters, chemical manufacturers, engineers, founders, tinplate manufacturers, dealers in metals and petroleum and other mineral oils, dealers in machinery and apparatus for manufacturing, increasing and improving the illuminating or heating power of gas, spirit, oil, petroleum and heat-producing agents, suppliers of electricity for light, heat, motive power or otherwise, &c., and to adopt an agreement with the London and Vancouver Syndicate. The signatories (with one share each) are:—R. Macmecken, Moorgate Station Chambers, E.C., accountant; R. H. Frisley, Moorgate Station Chambers, E.C., and Chicago and Vancouver, British Columbia, broker; C. Sofrano, 25, St. Mary Axe, E.C., gentleman; J. M. Fulton, Moorgate Station Chambers, E.C., chartered accountant; A. A. Amos, 285, Lea Bridge Road, Leyton, clerk; A. J. Swan, 4, Sutherland Road, Chiswick, clerk; S. H. Penwarden, 36, Peterborough Road, Leyton, clerk. Minimum cash subscription seven shares. The first directors (to number not less than three or more than seven) are to be appointed by the signatories; qualification, £100; remuneration, £250 each per annum (chairman, £350). Registered office, Moorgate Station Chambers, Moorfields, E.C.

Stoffels Electric Switch Co., Ltd. (120,285).—This company was registered on February 15th, with a capital of £25,000 in £1 shares, to acquire and turn to account any invention relating to electric tramways and railways and the working thereof, in particular to acquire from K. W. G. J. Stoffels the benefit in respect of certain countries of an invention relating to self-acting tramway points and certain patents relating thereto. The subscribers (with 250 shares each) are:—W. O. Burt, 41, Eastcheap, E.C., merchant; J. L. Burt, 41, Eastcheap, E.C., merchant. Private company. The number of directors is not to be less than two or more than five; the first are:—K. W. G. J. Stoffels, J. L. Burt, W. O. Burt, J. B. van der Sprenkel and one other to be appointed before annual general meeting in 1913; qualification, £250 shares. Registered by Ballantyne, McNair & Clifford, 150, Leadenhall Street, E.C.

Cantie Switch Co., Ltd. (120,197).—This company was registered on February 12th, with a capital of £500, in £1 shares, to take over the business of the Cantie Switch Co., carried on by H. W. Cox at Mount Street, Nottingham, and to carry on the business of electrical engineers, electricians and contractors, suppliers of electricity, manufacturers of electric apparatus, &c. The subscribers (with one share each) are:—W. F. Cox, Tavistock Chambers, the Market Place, Nottingham, solicitor; H. W. Cox, 67, Mount Street, Nottingham, electrical engineer. Private company. H. W. Cox is the first director. Registered office: 67, Mount Street, Nottingham.

Honiton and District Electric Supply Co., Ltd. (120,319).—This company was registered on February 17th, with a capital of £7,000 in £1 shares, to carry on at Honiton and elsewhere in Devonshire the business of an electric supply company in all its branches, and to take a transfer of all the rights, privileges, liabilities and obligations conferred or imposed upon J. A. Purves and W. T. Purves, of Exeter, by the Corporation of Honiton, under an agreement dated October 4th, 1911. The subscribers are:—C. Harding, Burwood, Honiton, draper, 200 shares; S. Cox, The Gables, Honiton, gentleman, 50 shares; J. A. Purves, 6, Pennsylvania Park, Exeter, C.E., 50 shares; C. P. Slade, High Street, Honiton, engineer, 25 shares; C. N. Tweed, Kingslea, Honiton, solicitor, 25 shares; H. L. Rundle, Holyshute, Honiton, solicitor, 20 shares; J. A. S. Altham, The Central Garage, Honiton, motor engineer, 5 shares. Minimum cash subscription, 3,500 shares. The number of directors is not to be less than three or more than seven; the first are C. Harding (chairman), S. Cox, J. A. Purves, C. P. Slade and C. N. Tweed; qualification, 250 shares; remuneration as fixed by the company. Registered office, High Street, Honiton.

Spanish and General Wireless Trust, Ltd. (120,299).—Registered February 16th, by Coward & Hawksley, Sons & Chance, 30, Mincing Lane, E.C. Capital, £350,000 in £1 shares. Objects: To acquire, hold, sell and turn to account shares, stocks and securities of any wireless or other telegraph company carrying on business in business in Spain or elsewhere, &c. The signatories (with one share each) are:—H. W. Allen, 51, Braxted Park, Streatham, S.W., company secretary; A. S. Birch, 24, Goldsmith Road, Leyton, private secretary; G. E. Turnbull, Charing Cross Hotel, S.W., electrical engineer; H. W. Cornby, 84, Cecile Park, Crouch Hill, N., assistant secretary; G. Pells, 29, King's Road, Leytonstone, private secretary; C. J. Ketteridge, 514c, Wandsworth Road, Clapham, S.W., transfer clerk; R. H. Hill, 141, Winchester Road, Highams Park, Essex, transfer clerk. Minimum cash subscription, seven shares. The first directors (to number not less than three or more than seven) are to be appointed by the signatories. Qualification, £100; remuneration, £400 each per annum, and a percentage of the profits. Registered office, Watergate House, York Buildings, Adelphi, W.C.

G. M. Boddy & Co., Ltd. (120,246).—This company was registered on February 14th, with a capital of £1,000 in 950 preference shares of £1 each, and 1,000 ordinary shares of 1s. each, to take over the business of an electrical engineer, factor and agent for the sale of electric lamps and other electrical appliances and apparatus carried on at 8, Leadenhall Street, E.C., by G. M. Boddy as G. M. Boddy & Co. The subscribers (with one preference share each) are:—G. M. Boddy, 8, Leadenhall Street, E.C., electrical engineer; H. G. H. Wilkinson, 166, Melrose Avenue, Cricklewood, N.W., gentleman. Private company. The number of directors is not to be less than two or more than five; the first are G. M. Boddy and H. G. H. Wilkinson (both permanent); qualification, one share. Registered by Adkin & Son, 15, Dowgate Hill, E.C.

A. Richmond Turner & Co., Ltd. (8,153).—This company was registered in Edinburgh on February 15th, with a capital of £1,000 in £1 shares, to acquire and carry on the business of Albert R. Turner & Co., electrical engineers, 676, Eglington Street, Glasgow. The subscribers (with one share each) are: A. A. R. Turner, 676, Eglington Street, Glasgow, electrical engineer; F. Evans, 100, Bothwell Street, Glasgow, commission agent. Private company. A. R. Turner is the first director. Registered by John Oswald & Sons, Edinburgh.

CITY NOTES.

Westminster Electric Supply Corporation, Ltd.

The directors' report for 1911, announces that Lord Suffield, while still retaining a seat at the board, has resigned the chairmanship, and Mr. J. Browne Martin has been appointed in his place. The directors report the death of Mr. Edmund Boulnois, who had served as a director for 23 years. Mr. Montagu Gluckstein has been elected to the vacancy. The supply of current has increased from the equivalent of about 33,800 KW. to the equivalent of about 35,460 KW. The length of roadway in which continuous-current mains have been laid now exceeds 90 miles, making about 361 miles of ways, into which upwards of 273 miles of copper (strip and cable) has been drawn. In addition, six miles of trunk mains (35 miles of ways) are laid in the company's area to connect the stations with the Central Electric Supply Co.'s station at St. John's Wood. An interim dividend, at the rate of 10 per cent. per annum on the ordinary shares, and the dividend on the 4½ per cent. preference shares for the half-year ending June 30th, 1911, have been distributed. After allowing for depreciation, sinking fund and other charges, the net balance is £47,290, from which must be deducted the second half-year's dividend on the preference shares, which absorbed £10,788, leaving a balance of £36,502. Out of this the board recommend the payment of a dividend at the rate of 10 per cent. per annum, less income-tax, for the past half-year, carrying forward £10,607.

Units sold	18,049,133	Total 18,509,068
,, used on works, &c.	459,935	
KW. on circuit, December, 1911 ..	35,337	

The meeting is called for February 28th.

British L. M. Ericsson Manufacturing Co., Ltd.—The annual meeting was held yesterday in London. The report, which was adopted, showed that the result of last year's working was a net profit of £27,144, or 27 per cent. on the capital, after heavy depreciation of the capital assets. We shall refer to the matter more fully next week.

Tyneside Electrical Development Co., Ltd.—A further dividend of 10 per cent. is recommended, making the usual distribution of 15 per cent. for the year.

Para Electric Railways and Lighting Co., Ltd.—A final dividend is to be paid of £5 per cent. on the ordinary shares, making 10 per cent. for the year, the same as for 1910.

Scarborough Electric Supply Co., Ltd.—The directors' report states that after placing £1,000 to depreciation, there is a balance on revenue account of £3,242, and the directors recommend a dividend, free of income-tax, at the rate of 3 per cent. for the year, leaving £242 to be carried forward. During the year 2,849 30-watt lamps (equiv.) were added, making 114,187. The units supplied, including 300,000 for the tramways, were 859,853, an increase of 26,974. Metallic-filament lamps, which at first tended to reduce receipts, are now attracting a sufficient number of new consumers to counteract this adverse effect.

South Metropolitan Electric Light and Power Co., Ltd.

In the directors' report for the year ended December 31st, 1911, the revenue account shows a credit balance of £31,072, which, with £1,243 brought forward, makes a total of £32,315. After deducting £11,740 for interest on debenture stock paid and accrued, and for other interest, £5,004 for interim dividend paid on the 7 per cent. cumulative first preference shares, and £1,500 for interim dividend paid on the 6 per cent. cumulative second preference shares, there remains a balance of £14,071. The directors recommend payment of a final dividend to December 31st, upon the 7 per cent. cumulative first preference shares, requiring £5,004; final dividend to December 31st, upon the 6 per cent. cumulative second preference shares, £1,500; placing to credit of depreciation account, £3,000; to credit of preliminary expenses, £1,500; the balance of £3,067 to be carried forward. The following comparative figures show the progress of the company's business:—

Year.	Lamps (35-watt). Connected.	Inc.	No. of consumers.	Gross revenue.	Expenditure.	Net revenue.
1907	160 380	15,668	3,383	£43,302	£16,234	£27,068
1908	177,628	17,248	3,649	42,954	15,978	26,976
1909	191,302	13,674	3,916	41,847	16,465	25,382
1910	208,046	16,744	4,305	44,687	17,678	27,009
1911	230,191	22,145	4,697	51,614	20,541	31,072

The company's showroom has been much appreciated by consumers, and has assisted the development of the business generally. The West Kent Electric Co.'s business is steadily developing. A further £10,000 4½ per cent. first mortgage debenture stock has been issued during the year. The dividend warrants will be posted on Tuesday, 27th inst.

National Electric Supply Co., Ltd., Preston.—A general meeting of shareholders was held on February 15th, Mr. J. Booth presiding. Dividends of 4 per cent. on preference shares and 4s. on each ordinary share (the latter making 7s. for the year) were declared. The Chairman moved the adoption of the report, and said that £3,000 had been spent, chiefly on mains for new custom and on additions to the high-tension plant, to enable the company to deal economically with the growing demand for alternating motors. They had paid £2,881 for local rates, and had lodged an appeal against their assessment. Unless a settlement was arrived at, they must seriously consider making future additions to their plant outside the borough boundary. Owing to the use of metallic lamps, the revenue from lighting had been reduced, consumers saving from 50 per cent. to 70 per cent. in their bills by these lamps. The report was adopted.

Bruce Peebles & Co., Ltd.—The directors' report, to which we made brief allusion last week, and which comes before the annual meeting at Edinburgh to-day (Friday), says that further unsecured debentures amounting to £10,841, and shares amounting to £18,403, have been issued in accordance with the scheme of reconstruction. The liquidation of the old company is completed, and a petition is being presented to the court for the discharge of the liquidators. The results for the year show an improvement of £7,629, as compared with the previous year. The profit, after deducting maintenance, general charges, expenses of administration, and the interest paid on the mortgage debentures and accrued on the unsecured debentures, is £354 for the year. No material improvement has been shown in trade conditions during the year, but continuous attention having been given to the extension of the business both at home and abroad, the gradual progress of the business is reflected in the present accounts.

Crossley Bros., Ltd.—The directors' report for 1911 shows that the amount to the credit of revenue account is £83,002. After paying 5 per cent. on the preference and 4 per cent. on the ordinary shares for the year, £10,000 is placed to the reserve fund, and the balance of £30,020 is carried forward. The decrease in profits is due to the serious labour troubles experienced during the year and the consequent reduction in the output. The directors regret the death of their late chairman, Sir William Crossley, Bart. Three members of the staff, Mr. Joseph James Carter, Mr. James O'Hanlon and Mr. Wilfred L. Webb, were appointed directors in July last.

Mather & Platt, Ltd.—The directors have declared a dividend on the ordinary shares at the rate of 10 per cent. per annum, with a bonus of 2 per cent., free of income-tax, less the interim dividend of 5 per cent. already paid.

British Engine, Boiler and Electrical Insurance Co., Ltd.—The report, as published in the *Financier*, states that the accounts for the year to December 31st show a disposable balance of £22,125, including £1,497 brought forward. A dividend of 5s. per share (£3 paid up) was paid in July, absorbing £5,100. The directors now recommend a final dividend of 5s. per share and a bonus of 3s. per share, less tax, absorbing £7,664, placing £7,000 to the reserve (making the same £83,000), leaving to carry forward £2,091.

Bournemouth and Poole Electricity Supply Co., Ltd.—The directorse announce a further dividend of 3 per cent., making 5½ per cent. for the year 1911.

London Electric Supply Corporation, Ltd.

The directors's report for the year ended December 31st, 1911, states that the profit for the year is £61,412, against £53,225 last year. To this is added £3,660 brought forward, less interest on temporary loan, viz., £115, making a total of £64,958. Out of this the interest on debenture stock to December 31st, viz., £15,494, has been paid, leaving a balance of £49,463 to be appropriated. The board recommend a dividend of 6 per cent. on the preference shares (of which an interim dividend of 3 per cent. was paid on September 1st, 1911) viz., £26,952; a dividend of 2½ per cent. on the ordinary shares, £8,325; to reserve account (making £77,500), £5,000; to contingencies account (making £10,000), £5,000; carrying forward, £4,186. The supply has been efficiently maintained during the year. The units sold were 20,476,982, as against 13,538,124 last year; the total costs per unit sold being ·82d., as against 1·03d. last year—a reduction of 21 per cent. The power supplied for traction purposes shows 73 per cent. increase, while the power supplied for industrial purposes shows 87 per cent. increase over last year. The capital expenditure for the year was £73,022, and was principally for new plant and mains in connection with the contract for the supply of power to the London, Brighton and South Coast Railway Co., and to deal with the extension of the electrification of their suburban system now proceeding. The plant and machinery have been maintained out of revenue, and are in efficient condition. The meeting is to be held to-day (Friday).

Kensington and Knightsbridge Electric Lighting Co., Ltd.—The directors' report for the year 1911 states that the renewal and reserve fund account now stands at £106,615, being an increase of £10,531 over the amount of the account at the end of the previous year. After providing for the amount placed to renewal and reserve fund account, and after paying the dividends on the 6 per cent. first preference shares to June 30th, 1911, on the 5 per cent. second preference shares to September 30th, 1911, and an interim dividend at the rate of 8 per cent. per annum on the ordinary shares for the first half of the year, the balance standing to the credit of the net revenue account for 1911 is £9,055. Of this sum £1,500 has been appropriated to the payment of the first preference dividend to the end of the year, and £625 has to be set aside to meet the portion of the dividend on the second preference shares accrued to the same date. It is proposed to pay out of the balance of £6,930 a further dividend on the ordinary shares at the rate of 10 per cent. per annum, for the past half-year, making, with the interim dividend paid on August 11th, 9 per cent. for the year. This will leave £1,680 to be carried forward. The meeting will be held on February 29th at Brompton Road.

Bristol Tramways and Carriage Co., Ltd.—Sir Geo. White presided at the annual meeting held on February 14th. In moving the adoption of the report (see ELECTRICAL REVIEW, page 223), he said that the receipts of the tramways department showed an increase of 3½ per cent., and those of the carriage department advanced by 20 per cent. The traffic expenses increased by £9,200, and the general expenses decreased by £2,068. Rates and taxes were £13,465, and the total dividend for the ordinary shareholders amounted to £18,833. There would, however, be a considerable diminution in their future charges for city rates, owing to the recent decision of the Court of Appeal that tramways paid in the same proportion as the railways. The report was adopted.

Brompton and Kensington Electricity Supply Co., Ltd.—It is announced that after crediting depreciation account with £6,063, and carrying to reserve fund £6,000 (raising the fund to £30,000), a final dividend on the ordinary shares at the rate of 11 per cent. per annum, making 10 per cent. for the year, tax free is recommended, carrying forward £7,858.

City of London Electric Lighting Co., Ltd.—The directors last week decided, subject to the completion of the audit, to place £50,000 to reserve, and to recommend a dividend of 12s. per share, being at the full rate of 6 per cent. per annum on the preference shares, and a dividend of 16s. per share, being at the rate of 8 per cent. per annum on the ordinary shares. On account of these dividends, 6s. per preference share and 6s. per ordinary share was paid in September, 1911, and the balance remains to be paid. After payment of these dividends and other appropriations there will remain about £26,000 to be carried forward. The total dividend on the ordinary shares for 1910 was 7 per cent.

Lancashire United Tramways Co., Ltd.—The directors report that the receipts amounted to £24,191, leaving a net profit of £12,783 for 1911. After paying the interest on prior lien debenture stock, £12,500, the balance, £283, is carried to depreciation.

Chatham and District Light Railways Co.—Mr. A. R. Monks presided on February 13th at 83, Cannon Street, E.C., over the twenty-first ordinary general meeting of the above company. On the motion of the chairman, seconded by Mr. H. C. Lewis, the report (see ELECTRICAL REVIEW, page 186), was adopted without discussion.

Northwich Electric Supply Co., Ltd.—The directors have declared a dividend of 5 per cent. on the cumulative preference shares, and 3 per cent. on the ordinary shares.

Vulcan Boiler and General Insurance Co., Ltd.—The directors have declared a dividend of 6s. per share and 2s. per share bonus.

Liverpool Overhead Railway Co.

The half-yearly meeting of this company was held on February 13th, at Liverpool, Mr. H. C. Woodward presiding, in the absence of Sir Wm. Forwood, who was unwell.

The Chairman, in moving the adoption of the report (see Electrical Review, page 222), deplored the rather sudden death of their colleague on the board, Mr. George H. Robertson. Mr. Robertson was one of the promoters of the company, and during the 24 years he always took the keenest interest in its welfare. As one of the promoters of the line he could claim to be one of the pioneers of electric traction in this country, for theirs was the first electric railway. The adoption of electric traction required no ordinary courage, and also knowledge of the science then very much in its infancy; but Mr. Robertson had already thrown himself enthusiastically into the promotion of the telephone system, and electric traction therefore strongly appealed to him. The telephone service, which had now been taken over by the Government, would remain a monument of his industry, courage, and foresight, for to him more than to any other man, the success of the great enterprise was due. They ventured to think that the accounts would be regarded as satisfactory and encouraging. The gross traffic (rail and tram) for the half-year showed an increase of 347,206 passengers, representing £2,451. This increase was general in all classes of travel, and was due to the improved trade of the port, and the long spell of fine weather last summer; and the large increase was carried at an extra cost of only £119. Within the past few weeks they had carried the record number of workmen since the line was opened, their earnings per workman carried being 1·23d., compared with 1·24d. last year. The average value of all their passengers was 1·71d. In the good old times, before they were worried by tramways, their average earnings were 1·93d. If they could have maintained that rate, their earnings last half-year would have been £4,127 more than they were. There were some small increases, and some small decreases in expenditure, but the result of the whole showed that they had carried that large number of passengers at a net cost of ·082d. per passenger, or, roughly, one-twelfth of a penny per passenger. He thought that reflected great credit upon the management. They had placed, as usual, £1,500 to the credit of their renewal fund, which now amounted to £43,866, and to the credit of the contingent fund £1,300, with £858 to the credit of the insurance fund. The total revenue for the half-year amounted to £40,791. Deducting from that the working expenses, £27,687, they had a balance of £13,103. Out of that they had paid interest on their mortgage debentures, £4,329, leaving £8,773 to be added to the amount brought forward, £4,665, which left available for dividend £13,439. They recommended a 5 per cent. dividend on the preference shares, and at the rate of 2 per cent. per annum on the ordinary shares of the company, carrying forward £4,763. They had always endeavoured to cultivate good relationships with those in their employ, and they had encouraged them to go direct to the board if they had any grievance. That, however, did not save them from trouble during the general strike in August last, but they were glad to say that one-sixth of their staff remained loyal, and they were able to conduct a modified service. This dislocation of traffic entailed some loss upon them, and the increases they had granted in pay, and alterations in the conditions of their service, involved an increase in their expenditure. The board were in the habit of meeting the shareholders every six months, and he did not think the prophets of old were called upon to prophesy every six months; and if they did, it was in cryptic terms. He did not wish to prophesy. They all knew Liverpool as well as he did. As long as trade was good in the port, their railway would do well. The new Atlantic dock was making rapid headway, and the construction of a further new dock at the north-end must be very advantageous to them in bringing more traffic to the railway. Since the close of the year their traffics had continued to expand in a satisfactory manner, the weekly increase averaging nearly £100.

Mr. J. E. Anderson seconded the motion for the adoption of the report, which was carried unanimously without comment.

Subsequently an extraordinary general meeting of the company was held to consider a new issue of debenture stock.

Mr. H. C. Woodward, who again presided, moved a resolution authorising the directors to raise £226,500 by the creation and issue of 4 per cent. debenture stock for that amount, subject to an agreement with the Mersey Dock Board. He explained that this was no new burden on the company. Their present debentures expired at the end of the current year, and the Dock Board undertook to guarantee the interest on the new debentures if from any reason the railway should be unable to meet the interest. The new debentures would practically rank as security. They would be permanent stock instead of terminable debentures.

Mr. J. E. Anderson seconded, and the resolution was carried unanimously.

Mersey Railway Co.

Mr. J. Falconer, M.P., presided at Worcester House, E.C., on Friday, over the half-yearly meeting of this company.

In moving the adoption of the report (see Electrical Review, page 227), the Chairman said the outstanding feature of the accounts was one which must be gratifying to everybody, inasmuch as for the first time in the history of the company they had been able to pay the interest due upon certain class of their original debenture stocks. With the exception of the new debenture stock raised for electrifying the railway under the Act of 1900, this was the first time in the history of the company when any return had been made upon the original capital provided for the purpose of constructing the railway. This was a thing on which the debenture-holders were to be congratulated, and it was a step forward which must be satisfactory also to shareholders, although their time for receiving a dividend had not yet come. In order that the shareholders might see what the progress had been since the electrification of the line, he might give a few figures. In 1900 they had redeemable debenture stock bearing 4 per cent. interest, but the period for the redemption of which had gone by. They also had arrears of interest upon other debenture stocks amounting to £450,844, and the company was in the hands of a Receiver. The Act of 1900 was introduced for the purpose of dealing with the financial situation and providing the capital for enabling the line to be worked electrically. They found the capital to replace the redeemable 4 per cent. stock, and also the money to electrify the line, and the results of the electrical working had been very striking in every respect. They completely got rid of the steam and smoke which made the tunnel almost offensive as a means of travelling, and they had now a perfect atmosphere both in summer and winter. Their train service was now practically one of three minutes, and as a matter of fact they ran twice the number of trains they did under steam working. Their lifts had been accelerated, and the result was that in the half-year they were dealing with they had carried 7,383,000 passengers, as against 3,357,000 in the last year of steam working—an increase of 4,000,000, or 120 per cent. Their gross revenue had increased from £29,470 in the last half-year of steam working to £54,150, an increase equal to 83·75 per cent. The expenditure for working in the last half-year of steam working was £28,282, whilst in the half-year under review it was £30,190, or only 6·5 per cent. more. So that whilst the train service and the traffic had doubled, the working expenses had remained practically the same as they were under the old conditions. The net revenue during the last half-year of steam working was £1,188, whilst during this half-year it was £23,960. At the same time they had built up a renewal fund amounting to £16,000. The results showed that the system of working and the policy they had pursued, were for the interests of the public and of the shareholders. Since electrical working had been adopted there had been a continuous progress in the development of the traffic, but it was right to point out that in the half-year under review there had been a slight drop; this took place during July, August and September, when they had to contend against abnormal heat and the railway strike, which, as everyone knew, was more acute in Liverpool than anywhere else. In September, when the railway strike passed away, they resumed their normal condition, and the succeeding months showed an increase in the traffic. This showed that the districts served by the railway were being steadily developed; and whilst he did not care to prophesy, still he was bound to say that, having now for eight years had continuous development, they saw no reason why there should be a different state of things in the future. So long as they continued to give the excellent service they did, they had reason to believe that the growth of their traffic would continue. As regarded the accounts, the only item he would refer to was the proposed expenditure of £6,631 on plant during the current half-year and succeeding half-years. The plant in question was a turbo-generator of 800-kw. capacity. At the present time they were working with three engines of 1,200 kw. each, and after careful consideration by the engineer and the board they were satisfied that it would be a substantial advantage to have the new generator, as it would effect a considerable economy in running expenses. He hoped that when the plant was fixed they would find that the working expenses were even lower than in the old steam days. It would be seen that the board had paid the full interest on the 1866 debenture stock and the 1871 stock, and had paid £1 13s. 2½d. on the 1882, 1883 and 1885 stock, the total sum utilised being £13,643. He thought the shareholders of the company were greatly indebted to the debenture-holders for the consideration they had shown in the past, and he hoped before long the shareholders also would receive a dividend.

Mr. R. Cooper seconded the motion.

Replying to questions raised by Mr. Sherrett and Mr. Sykes, the Chairman said the board were large ordinary shareholders. Personally, his own interest was larger in the ordinary shares than in the debentures. It would require the earning of £13,287 more, for the company to pay the full dividends on the whole of the debenture stocks before the preference stock received anything. He saw no reason why they should not go on increasing their earnings, for the company was perfectly capable of dealing with a large increase in traffic. That was one of the advantages of electrical working.

The report was adopted.

Dublin and Lucan Electric Railway Co.—The half-yearly meeting was held at Dublin on February 15th, Mr. J. W. Hill presiding. The directors' report showed that the gross receipts were £3,960, or £47 less than in the corresponding half of 1910. The expenditure had increased by £217. After providing for debenture interest, there was an available balance of £1,124, out of which the dividend on the 5 per cent. preference shares was to be paid, £102 being allocated to provision of mechanical stokers, £21 to an alternative feed water supply at the power station, £526 being carried forward, as compared with £531 in 1910. In the course of his remarks, the chairman said that through the mechanical stokers which were put in a few months ago, they consumed about 80 tons of coal less.

Stock Exchange Notices.—Applications have been made to the Committee to appoint a special settling day in, and to grant a quotation to, Marconi's Wireless Telegraph Co., Ltd.—Further issue of 22,989 7 per cent. cumulative participating preference shares of £1 each, fully paid, Nos. 727,012 to 750,000.

Lanarkshire Tramways Co.

Mr. A. R. Monks (chairman) presided on February 13th at the offices, 83, Cannon Street, E.C., over the twenty-first ordinary general meeting of the above company.

The Chairman, in moving the adoption of the report (see Electrical Review, page 226), said the extension to New Stevenston was completed and opened for traffic on July 31st. This extension cost £10,680 and also involved a payment of £3,500 to the Burgh of Motherwell towards the cost of building a new bridge over the Calder. Four additional cars were also purchased for the extension, at a cost of £2,760. To meet part of this capital expenditure, £14,650 debentures were issued at £95 per cent., the discount and expenses of the issue, aggregating £762, being written off. The traffic receipts showed an increase for the first half of the year of £320 and for the second half an increase of £2,250—a total of £2,570. The increase in the second half was, of course, mainly due to the opening of the New Stevenston extension. Advertising and other sundry revenue items were also in excess of the previous year, which made a net gain in the gross revenue of £2,640. Taking the expenses, their power costs showed an increase of £230, the increased charges being due to the additional mileage run, but the other expense accounts were all lower. Traction expenses were £600 less, maintenance charges for permanent way and overhead line not being so heavy as in the previous year. There was a small saving in parcels expenses, and a substantial reduction of £530 in general expenses. The increase in their takings and the reduction in the expenses gave them an improvement of £3,570 in the gross profit, and he thought they would agree that the results for the year were highly satisfactory. The board had added £9,000 for the past year to reserve for depreciation, and interest amounting to £1,555 had also been credited to the reserve, making £51,815 at credit as at December 31st. £15,632 had been invested in first-class securities, and the balance was in their own undertaking. After writing £849 off cost of orders, loose tools, &c., £762 in connection with the debenture issue, and making the necessary reserves for local authorities and for additional remuneration to the directors, the balance allowed for payment of a dividend for the half-year at the rate of 6½ per cent. per annum (making 6 per cent. dividend for the full year), and left £1,385 to carry forward. In addition to their wayleave for the year of £2,890, they paid £3,230 for local rates, a total payment to the local authorities for the year of £6,120. As mentioned in the report, the Lanark County Council was promoting a Bill to construct tramways from Uddingston to Bellshill and Mossend, and to connect up with their lines, and, further, to acquire this company's undertaking forthwith. It was their intention to oppose the Bill, and they were satisfied that Parliament would not grant the powers asked for.

Mr. J. F. Nauheim seconded the motion, which was carried without discussion.

On the motion of Mr. Watson, it was agreed:—

That the remuneration of the board of directors be at the rate of 1,000 guineas per annum, to be divided as may be determined by them, and that they shall also be entitled to receive in each year, as heretofore, 10 per cent. of the net profits of the company remaining in that year after payment of a dividend of 5 per cent. on the amounts paid on the share capital, such additional remuneration to be divisible among the board equally. The board shall be entitled to charge and be paid all travelling and other out-of-pocket expenses incurred in the discharge of their duties.

Tyneside Tramways and Tramroads Co.

The half-yearly meeting was held in Newcastle-on-Tyne on February 13th, Dr. J. T. Merz presiding.

The report of the directors showed that the surplus of receipts over expenses was £4,587, plus £620 brought forward from last half-year, making a total to the credit of profit and loss account of £5,207, and after deducting interest on debentures, loans, &c., amounting to £962, there remained an available balance of £4,244. The directors recommended a dividend on the preference shares at the rate of 5 per cent. per annum (less income-tax), £601; a dividend on the ordinary shares at the rate of 2½ per cent. per annum (less income-tax), as compared with 1¼ per cent. for the corresponding half-year of 1910, £1,674; placing to the credit of reserve for renewals, depreciation and other contingencies (thus increasing it to £10,700), £600; setting aside for the reduction of registration and formation expenses, &c., £180; writing down the Consols owned by the company to present market value, £817; leaving to be carried forward £373. The dividend paid on the ordinary shares for the whole year was an increase of ¾ per cent. over that for 1910. The traffic receipts show an increase of £2,150 for the half-year, making an increase for the whole year of £2,983. The whole of the track, overhead line and rolling stock has been kept in thorough repair during the past year out of revenue.

The Chairman stated that the increased traffic was made up of £130 on holiday traffic, £475 on workmen's traffic, and £2,378 on the ordinary traffic. They had passed the record of 1907, when the year's receipts were just above £24,000. Their receipts per car-mile had been 8·87d. against 7·95d., and as their minimum was 7·24d., it showed that they had made considerable progress. Their costs stood at 5·99d., as compared with 5·81d. Out of their increased profits they had paid £1,004 more for dividends, the rate being 2 per cent., as against 1¼ per cent. for the previous year. They had placed £1,600 to the reserve, as against £1,500. They had written off £381 expenses in opposing the Corporation Bill. They had also written down Consols even below their present market value—to 77⅛. In the course of the current year and in coming years they hoped to have sums to invest, and they would be invested where they would be get-at-able, because they would have to anticipate expensive repairs in the lines and cars, which would mean calling upon the reserve fund. So far, for the present year, the increase in traffic receipts was £130, against an increase in the corresponding period last year of £117. How that would go on it was impossible to foretell. They did not view the future without some apprehension that their regular and profitable working might be disturbed. But it was impossible to make any forecast. If such disturbance did not take place, they looked forward to the future with hope that they would have better returns still.

Mr. G. E. Henderson seconded the report and accounts, which were adopted.

On the motion of the Chairman, seconded by Lord Armstrong, the dividends were carried in accordance with the report. The retiring directors and auditor were reappointed.

City of Buenos Ayres Tramways Co. (1904), Ltd.

This company's meeting was held on Thursday last week at Winchester House, E.C., Mr. John Heaton presiding.

The Chairman, in moving the adoption of the report, said they followed those of previous years so closely that he did not think they would have any hesitation about adopting them. The two important matters which they had now to consider in connection with the company were, first, whether the annuity receivable from the Anglo-Argentine Co. had been regularly paid, and secondly, as to whether the amortisation funds had been sufficiently maintained. As regarded the first, it was always a satisfaction to him to be able to refer to the increased security that they got for their annuity. When they first proposed the fusion scheme, the security was considered quite ample. It was then £70,000 a year, and the revenue of the Anglo-Argentine Co. was £250,000. The revenue of the latter company had increased very largely, and for last year it had amounted to no less than £900,000, against which their annuity of £70,000 a year was a first charge. As an instance of the enormous resources of the Anglo-Argentine Co., he might mention that the general manager was over here a short time ago, and in the course of conversation he told him (the chairman) that he believed that next year they would be able to pay the annuity out of the advertisements on the cars. As regarded the amortisation funds, they had the written assurance of the auditors that they had been fully maintained. The amount they placed to the general amortisation fund was a little less than last year, but the explanation was quite satisfactory. During the year two leases upon their properties fell in, and they had to make new contracts, and in one case a new tenant had to be found. That was done, and it would be a satisfaction to them to know that the new rents they would obtain, would be considerably in excess of those they received before. That improvement would, of course, be for the benefit of the amortisation funds. They had already paid three quarterly dividends, and they proposed now to pay the balance of 1s. 3d. per share.

Mr. E. H. Woods seconded the motion, which was carried unanimously.

Bath Electric Tramways, Ltd.

In their report the directors state that the traffic receipts show an increase of £1,462, compared with those of the previous year. The earnings for the past five years are:—1907, £41,452; 1908, £38,395; 1909, £40,136; 1910, £42,372; 1911, £43,334. The efficiency of the company's system, including the permanent way, rolling stock and plant, has been fully maintained. The acquisition of the site adjoining the power station, with the foundry erected thereon, which was referred to in last year's report, has been fully justified by results, the orders in hand at the present time keeping the plant fully occupied. After charging the expenses of operation and administration for the year ended December 31st, 1911, there remains a balance of £15,392, plus £6,697 brought forward, a total of £22,088. From this has to be deducted £6,037, interest on 4½ per cent. first mortgage debenture stock, paid and accrued to date; £1,000, fourth instalment of sinking fund for first mortgage debentures; £1,163, interest on loans; £3,750, dividend on the preference shares for the year to December 31st, 1911, paid July 1st, 1911, and January 1st, 1912, a total of £11,950, leaving a balance of £10,138, which the directors recommend should be carried forward pending the repayment of the loan, now reduced to £22,650. The year has been a record one in the history of the company, and the marked increase in the carry forward, which was £10,138 this year, as compared with £6,697 last year, an increase of no less than £3,441. The figure in 1909 was £3,964. In both the matter of the balances carried forward and the annual earnings there had been a steady and satisfactory progress. Expenses at Bath in 1911 show an increase of about £900 upon 1910, the total being £26,974. Power expenses accounted for £3,699, as compared with £3,536. Operating, including petrol, wages, &c., amounted to £12,662, as compared with £12,636. Repairs and renewals were about the same—£5,534, as against £5,333. Management expenses advanced from £2,257 to £2,522. Rents, rates and taxes and insurance accounted for £1,568, against £1,394, and parcels cost £989, as against £908.

STOCKS AND SHARES.

Tuesday Evening.

Over the whole of the markets has been hanging the cloud of the possibility of a coal strike. The fear of what might happen, were a national stoppage to take place, held business in a close grip.

Everybody was afraid to launch out into fresh commitments. When the rumour got round that the Government was about to move, possibly through the channel of the Eight Hours' Bill, a better sentiment supervened; but until something more definite is known than is available as we write, timidity and caution are the characteristic features in most of the markets.

Home Railway stocks are distinguished by a material rise in City and South London Ordinary, where the price has put on 4 to 32½ middle. It is pointed out that the stock has been overlooked in the rush to buy Tube issues; and, moreover, with the extension of the Underground system, the City and South London should benefit with the rest of the companies. Moreover, there is an idea that the line may go further South. Apart from this, the tendency has been moving in sympathy with that prevailing in the market for steam stocks. Metropolitan Consolidated fell 1½, and Districts slumped 1½, while Underground Electric Income bonds went back 2. For these last two movements the reason generally assigned was that the stale bulls were hastening to get out while they were able to do so at decent prices, but Districts and Metropolitans shared in the recovery, and the losses on balance are small. The Central London trio is marked *ex* dividend; allowing for this, the Deferred stock is 2 down, and the Ordinary 1½. Great Northern and City Preferred Ordinary went back ⅛, and a similar fraction was lost by London United Tramways Preference, where the recent buyers are a little uneasy at the failure of the shares to go ahead. British Electric Tractions are being put up by speculative purchases, the 7 per cent. Preferred being most favoured, and showing a rise of 3½; but the Deferred, with an improvement of 1½, attracts a certain amount of attention from those who like a low-priced gamble. Metropolitan Electric Trams are hardly so good, while Potteries Ordinary are $\frac{1}{16}$ up.

A number of the English Electricity Supply Companies have declared their dividends, and most of the results are distinctly satisfactory. City of London rose ⅛ further upon the announcement of a dividend of 16s. per share. Counties are no less than ⅜ higher, the Preference rose ⅛, and the Second Debenture is 1 higher. There are improvements in Bournemouth and Poole Ordinary, Chelsea Ordinary, Charing Cross Ordinary, Brompton Preference, and Westminster Ordinary, while London Electric Ordinary are also harder. It would appear that those who are interested in the industry are backing their faith by fresh purchases and by persuading their friends to follow the same course; and although the aspirations of some of the bolder spirits may seem at the present time to lean to the side of optimism, the practical fact that so many of the shares return high rates of dividend at the present prices is sufficiently attractive to induce buying.

Shawinigan Water, after going back a little, was strongly supported, and the net gain of 5½ is more than double the fall which occurred last week. Mexican issues are still rather doubtful, and quotations tend to decline, the progress of the "Revolution" being a restraining factor. Sao Paulo Trams have recovered their fall, and Rio Trams are a good market, the two classes of bonds being in considerable demand. Anglo-Argentine Trams First Preference lost ⅛, although the railway strike in the Republic is declared to be at an end. City of Buenos Ayres 4 per cent. Debenture has been marked up 5½.

British Columbia Electric Railway stocks are steady. Business in the various issues in this section continues to be active.

Manufacturing shares have another big rise in Babcock & Wilcox Ordinary as one outstanding feature. The price touched 7, but reverted to 6¾, this showing a gain of $\frac{5}{16}$, and dividend anticipations are very optimistic. Willans & Robinson Debenture rose 4 points further, while both classes of shares held their improvements. Last week's gain, too, in British Westinghouse Preference has been well maintained: the tip to buy them declares that the rise is by no means over. The demand for the shares led to speculative purchases of the 4 per cent. Debenture stock, the quotation for which has put on 4. Even now the 6 per cent. Prior Lien Debenture yields 5¾ per cent. on the money, and the 4 per cent. Debenture at 64 pays 6¼ per cent. Castner-Kellners are $\frac{1}{16}$ lower, and Dick, Kerr Preference $\frac{1}{32}$ higher.

Marconi shares are as lively a market as ever, and after touching 4⅜ bid, the price eased off to 4¼ upon the arrangement of the Special Settlement this week in the new shares. A huge speculative position for the rise was disclosed, and the bulls in some cases had to pay 10 per cent. for continuing their shares, the official making-up price of which was 2$\frac{13}{32}$ premium.

There has been a further setback in West India and Panama Telegraph Ordinary shares, and the market professes perplexity as to what the next movement is likely to be. Many people who got out at £5 and over are standing by with the intention of repurchasing when it seems desirable, for there is a widespread opinion that the group which engineered the recent boomlet is going to take the shares in hand again. So far as we can see, there need be no violent hurry to buy back the shares just yet, but it is all very much of a gamble, and the price might be run up to 5 before one could say Canal.

There is nothing very exciting on foot amongst other telegraph issues. American Telephone and Telegraph capital stock is 1½ higher, which made Anglo-American deferred brace up, and the two Mackay Companies' stocks are a little better upon the issue of a good report. Eastern Extensions are ⅛ up. Eastern Ordinary gained 1. The Reuter rumours, to which reference was made here last week, have brought about another advance in the shares, which now stand at 11. National Telephone Deferred begins to rally after its drop, the price being 1 higher.

ELECTRIC TRAMWAY AND RAILWAY TRAFFIC RETURNS.

Locality.	Fortnight ended.	Receipts for the fortnight. £	Receipts for the fortnight. £*	No. of wks.	Total to date. £	Total to date. £*	Route miles open.	Inc.
Aberdeen	Feb. 14	2,504	+ 110	37	55,562	+ 3,255	14·4	..
Ayr	„ 17	362	+ 2	40	12,340	+ 189	8	..
Bath	„ 14	1,297	— 1	7	4,602	+ 127	14·75	..
Birkenhead	„ 18	2,088	+ 98	46	52,790	+ 1,979	13·68	..
Birmingham Corp.	„ 10	19,654	+6,132	45	400,316	+87,910	56·4	..
Blackburn	„ 14	1,884	— 7	46½	56,306	+ 4,170	14·62	..
Blackpool Corp.	„ 15	688	— 68	..	61,470	+ 7,824	11·87	..
Blackpool-Fleetw'd	„ 17	483	+ 33	6	1,733	+ 72	8	..
Bournemouth	„ 14	2,738	+ 251	46	81,676	+ 846	21·95	..
Bradford	„ 10	9,499	— 29	45	246,018	+14,766	56	1·2
Brighton	„ 18	1,531	+ 129	46½	47,405	+ 2,630	9·5	..
Bristol	„ 16	11,759	+1,175	..	41,822	..	30·5	..
Brit. Elec. Trac. Co.								
Airdrie	„ 9	512	+ 105	6	1,565	+ 337	3·65	..
Barnsley	„ 9	458	+ 16	„	1,023	+ 90	..	..
Barrow	„ 9	599	+ 373	„	1,682	+ 441	5·37	..
Devonport	„ 9	992	+ 74	„	2,772	+ 3·8	8·85	..
Gateshead	„ 9	1,988	— 45	„	5,698	+ 74	11·25	..
Gravesend	„ 9	365	+ 29	„	1,103	+ 121	6·5	..
Greenock	„ 9	1,527	+ 185	„	3,770	+ 470	7·25	..
Hartlepool	„ 9	404	— 1	„	1,284	+ 117	6·72	..
Kidderminster	„ 9	168	— 1	„	488	+ 30	..	..
‡Leamington	„ 9	244	+ 12	„	764	+ 46	..	..
Merthyr	„ 9	365	+ 12	„	1,075	+ 68	2·9	..
Metropolitan	„ 9	15,282	+ 822	„	45,684	+ 3,850	22	..
Middleton	„ 9	495	— 52	„	1,487	— 70	8·5	..
Mid. Joint Com'tee	„ 9	5,520	— 19	„	15,962	+ 92	..	..
Oldham—Ashton	„ 9	1,017	+ 12	„	3,020	+ 136	9·13	..
Peterborough	„ 9	220	+ 29	„	627	+ 85	5·31	..
Potteries	„ 9	3,765	+ 128	„	10,947	+ 468	29	..
Rothesay	„ 9	76	+ 2	„	291	+ 37	2·75	..
Southport	„ 9	410	— 8	„	1,372	+ 5	8·17	..
S. Metropolitan	„ 9	1,234	— 54	„	3,880	+ 51	..	..
Swansea	„ 9	2,500	+ 242	„	6,218	+ 324	12·5	..
Tynemouth	„ 9	242	— 32	„	747	— 71	3·76	..
Weston-s-Mare	„ 9	47	+ 2	„	145	+ 51	3	..
‡Worcester	„ 9	415	+ 1	„	1,308	+ 25	5·75	..
Wrexham	„ 9	177	+ 13	„	517	+ 30	..	..
Yorks. Wool. Dist.	„ 9	1,863	— 96	„	5,752	+ 74	17	..
Miscellaneous	„ 9	370	— 11	„	1,123	+ 26	..	..
Burnley	„ 17	2,600	+ 218	..	..	..	11·78	..
Burton-on-Trent	„ 18	525	+ 50	46	13,568	+ 731	6·6	..
Bury	„ 18	2,255	+ 82	46½	58,714	+ 4,448	22·5	..
Cardiff	„ 17	4,461	+ 381	46	112,649	+ 8,255	17·35	..
Chatham and Dist.	„ 15	1,445	+ 96	7	4,941	— 75	14·9	..
Cork	„ 15	868	+ 9	7	2,781	+ 22	9·89	..
Croydon	„ 9	2,788	— 78	45	80,854	+ 5,205	11·6	·75
Darlington	„ 17	421	+ 48	47	10,575	+ 974	4·87	..
Darwen	„ 16	449	— 5	46	12,251	+ 799	4·30	..
Dover	„ 10	348	+ 31	45	11,415	+ 1,499	4·75	..
Dublin	„ 15	10,147	+ 241	..	35,159	+ 1,661	54·2	..
East Ham	„ 17	2,146	+ 182	46	50,858	+ 3,220	7·87	..
Exeter	„ 16	516	+ 24	46	15,578	+ 991	5·5	..
Glasgow	„ 17	34,801	— 99	..	706,148	+57,420	98	·25
Hastings	„ 16	1,327	— 4	..	..	— 183	19·3	..
Huddersfield	„ 17	3,588	+ 116	46	88,219	+ 7,709	29·6	1
Hull	„ 17	5,848	+ 396	46	135,860	+ 7,628	14·5	..
Ilkeston	„ 15	284	+ 10	46	6,028	+ 145	3·8	..
†Ipswich	„ 10	320	+ 14	45	19,860	+ 1,925	10·5	..
Kilmarnock	„ 10	276	+ 5	39	6,899	+ 451	4·42	..
Lancashire United	„ 7	2,336	+ 28	7	7,779	+ 14	39	..
Leeds	„ 17	14,280	+ 785	46	347,203	+23,046	57·5	..
Leicester	„ 17	5,623	+ 588	..	..	..	20	..
Leith	„ 17	1,186	+ 108	39½	25,771	+ 2,003	5·12	..
Liverpool	„ 10	21,834	+1,294	59	67,445	+ 4,404	118	..
‡L.C.C.	„ 7	77,727	+ 654	45½	1,967,176	+97,053	139·5	7
London United	„ 17	10,476	+ 105	..	36,106	+ 710	..	..
Lowestoft	„ 17	280	+ 17	20	3,297	+ 42	3·5	..
Manchester	„ 17	30,652	+1,335	46	747,910	+37,242	105	..
Newcastle	„ 17	8 262	+ 632	..	198,132	+15,010	31·3	..
Newport	„ 17	1,247	— 2	46	32,524	+ 1,058	7·25	..
Oldham	„ 18	3 607	+ 188	47	90,557	+ 3,876	23	..
Pontypridd	„ 17	809	+ 31	46	19,168	+ 40	5·5	..
Portsmouth	„ 10	3,020	+ 11	45	98,784	+ 6,971	15·25	..
Preston	„ 14	1,311	+ 43	46	35,901	+ 2,402	10	..
Rotherham	„ 15	1,302	+ 48	45	31,780	+ 2,493	12	..
Salford	„ 12	8 644	— 389	45½	220,990	+ 8,894	41	..
Sheffield	„ 20	12 841	+ 788	47½	305,589	+19,381	40	..
Southampton	„ 14	2,109	+ 246	46	56,690	+ 6,502	11	..
Southend-on-Sea	„ 14	847	+ 137	46	31,049	+ 4,747	7	..
South Shields	„ 17	1,114	+ 79	46	28,801	+ 3,018	10·25	..
†Swindon	„ 7	140	+ 12	45½	7,261	+ 815	3·7	..
Tyneside	„ 14	797	+ 21	7	2,688	+ 153	11	..
Wallasey	„ 17	1 846	+ 45	46	50,580	+ 6,322	8·72	..
Walthamstow	„ 17	1,253	+ 62	46	34 232	+ 2,075	9	..
West Ham	„ 8	4 830	+ 267	45	122,462	+10,719	15·25	..
Wolverhampton	„ 14	1,820	+ 107	46	45,274	+ 2,133	25	..
Cen. London Rly.	„ 17	10,078	— 422	7	35,899	— 2,189	6·22	..
City & S. Lon. Rly.	„ 18	6,787	+ 12	7	24,021	— 549	7·26	..
Dublin-Lucan Rly.	„ 16	199	— 14	7	712	+ 1	7	..
G.N. and City Rly.	„ 17	3 424	+ 249	7	12,018	+ 798	7	..
L'pool Overh'd Rly.	„ 18	2 948	+ 221	7	10,392	+ 709	6·6	..
Llandudno-Col. Bay	„ 16	241	+ 8	11½	1,481	+ 151	6·5	..
Lond. Elec. Ry. Co.	„ 17	29,690	+1,805	7	105,195	+ 5,416	21·25	..
Mersey Railway	„ 17	4 082	+ 123	7	14,614	+ 886	4·5	..
Metropolitan Rly.	„ 18	88,945	+ 492	7	120,935	+ 1,2·8	25·75	..
Met. District Rly.	„ 17	25,890	+1,851	7	88,642	+ 4,689	25	..
Anglo-Argentine	„ 18	103,298	+4,858	7	354,516	+13,211	..	..
§Auckland	Jan. 13	19 830	+1,761	6½	119,299	+ 9,814	23·3	..
Bombay (B.E.T.)	„ 19	6,966	+ 671	3	8,012	+ 869	..	..
§Brisbane	Jan.	17,084	+2,196	..	..	..	..	..
Brit. Columbia Rly.	..	..	..	..	..	..	..	..
Calcutta	Feb. 17	8,085	+ 752	..	..	+ 4,704	..	..
Cape Electric T.Ld.	..	..	..	..	..	..	..	..
§Kalgoorlie, W.A.	Jan.	2,884	..	..	..	..	20·5	..
§Lisbon	..	..	..	..	..	..	..	..
Madras	Feb. 15	1.548	+ 67	6	4 727	+ 71	..	..
§Montevideo	Jan.	26.651	+3 106	3	90,768	+ 8,058	..	..
Perth (W.A.)	Feb. 16	3 759	+ 457	7	13,166	+ 1,819	29	..

* Compared with the corresponding period of 1911. † One week only.
‡ Includes horse, steam and other receipts. § One month.

SHARE LIST OF ELECTRICAL COMPANIES.

ENGLISH ELECTRICITY SUPPLY AND POWER COMPANIES.

NAME.	Stock or Share.	Dividends for 1910.	Dividends for 1911.	Closing Quotations Feb. 20th.	Rise + or Fall —	Present Yield p.c. £ s. d.
Bournemouth & Poole, Ord.	10	5½	5†	8½ — 9½	+ ½	5 18 11
Do. 4½ % Pref.	10	4½	4½	8½ — 9½ xd	..	4 14 9
Do. Second 6 % Pref.	10	6	6	10½ — 11½ xd	+ ½	5 6 8
Do. 4½ % Deb. Stock	Stock	4½	4½	101 —102	..	4 8 3
Brompton & Kensington, Ord.	5	10	9†	8 — 8½	..	5 17 8
Do. 7 % Cum. Pref.	5	7	7	7½ — 8½	+ ½	4 4 10
Central Electric Supply, 4 % Guar. Deb.	100	4	4	98 —101	..	3 19 3
Charing Cross, West End & City	5	5	5†	3⅞ — 4⅛	+ ⅛	5 14 3
Do. 4½ % Cum. Pref.	5	4½	4½	4¼ — 4⅜ xd	..	4 17 4
Do. "City Undertaking" 4½ % Cum. Pref.	5	4½	4½	3⅞ — 4½	..	5 9 1
Do. Do. 4 % Deb.	100	4	4	93 — 96	..	4 3 4
Chelsea, Ord.	5	5	4†	4½ — 4⅝	+ ⅛	5 5 3
Do. 4½ % Deb.	Stock	4½	4½	98 —101	..	4 9 1
City of London, Ord.	10	7	6†	13⅝ — 14½	+ ⅛	4 19 1
Do. 6 % Cum. Pref.	10	6	6	12 — 13	..	4 14 4
Do. 5 % Deb.	Stock	5	5	117 —121	..	4 2 8
Do. 4½ % Second Deb.	100	4½	4½	100 —103	..	4 7 5
County of Durham, 5 % First Mort. Deb.	Stock	5	5	87 — 89	..	5 12 4
County of London, Ord.	10	5	4†	9½ — 10	+ ⅜	5 0 0
Do. 6 % Pref.	10	6	6	11⅝ — 11⅞	+ ⅛	5 3 3
Do. 4½ % Deb.	Stock	4½	4½	107 —109	..	4 2 7
Do. 4½ % Second Deb.	Stock	4½	4½	101 —104	+1	4 6 7
Edmundson's, Ord.	5	Nil	Nil	⅜ — ½	..	Nil
Do. 6 % Cum. Pref.	5	Nil	Nil	2¼ — 3¼	..	Nil
Do. 4½ % First Mort. Deb.	100	4½	4½	87 — 90	..	5 0 0
Folkestone	5	6	6†	4½ — 5	..	6 0 0
Do. 5 % Cum. Pref.	5	5	5	4⅝ — 5⅛	..	4 17 7
Do. 4½ % First Deb.	100	4½	4½	93 — 96	..	4 13 9
Hove	5	9	8†	6¾ — 7½	..	6 4 2
Kensington & Knightsbridge, Ord	5	9	8†	6¾ — 7½	..	6 4 2
Do. 4 % Deb.	Stock	4	4	92 — 95	..	4 4 3
Kent Elec. Power, 4½ % Deb.	Stock	4½	4½	78 — 82	..	5 9 9
London Electric, Ord.	3	2	..	1⅛ — 2	+ ⅛	2 19 11
Do. 6 % Pref.	5	6	6	4⅝ — 5	..	6 0 0
Do. 4 % First Mort. Deb.	Stock	4	4	86 — 91	..	4 8 0
Metropolitan	5	5	4†	3⅜ — 4⅛	..	5 17 8
Do. 4½ % Cum. Pref.	5	4½	4½	4¼ — 4⅜	..	4 17 4
Do. 4½ % First Mort. Deb.	Stock	4½	4½	99 —104	..	4 6 7
Do. 3½ % Mort. Deb.	Stock	3½	3½	84 — 87	..	4 0 6
Midland Electric Corporation 4½ % First Mort. Deb.	100	4½	4½	95 — 97	..	4 12 9
Newcastle-on-Tyne	5	4	4†	3¾ — 4	..	5 0 0
Do. 5 % Pref., Non-Cum.	5	5	5	4 — 4½	..	5 11 1
North Metropolitan Power Supply, 5 % Mortgages (Red.)	100	5	5	99 —102	..	4 18 0
Notting Hill, 6 % Non-Cum. Pref.	10	..	..	9⅞ — 10⅜	..	..
Oxford	5	7½	6†	6½ — 6⅝	..	5 9 5
St. James' and Pall Mall, Ord.	5	10	10	7⅞ — 8⅛ xd	..	5 19 5
Do. 7 % Pref.	5	7	7	6⅝ — 7⅛ xd	+ 1/16	4 16 7
Do. 3½ % Deb.	100	3½	3½	85 — 87	..	4 0 6
Smithfield Markets, Ord.	5	Nil	2	1⅜ — 1½ xd	+ ⅛	..
South London, Ord.	5	5	5	2⅜ — 2½	..	6 8 1
Do. 5 % First Mort. Deb.	100	5	5	98 —101	..	4 19 0
South Metropolitan, 7 % Pref.	1	7	7	1 — 1⅛	..	6 4 5
Do. 4½ % First Deb. Stock	100	4½	4½	97 —100	..	4 10 0
Urban, Ord.	5	5	..	2/16 — 3/16	..	..
Do. 5 % Cum. Pref.	5	5	..	2⅜ — 3⅜	..	..
Do. 4½ % First Mort. Deb.	100	4½	4½	88 — 90	..	5 0 0
Westminster, Ord.	5	10	10†	8⅝ — 8¾	+ ⅛	5 14 8
Do. 4½ % Cum. Pref.	5	4½	4½	4 1/16 — 5/16	..	4 6 9

COLONIAL AND FOREIGN ELECTRICITY SUPPLY AND POWER.

Adelaide, 6 % Pref.	5	6	6	5⅞ — 6	..	5 0 0
Calcutta, Ord.	5	8½	7†	6½ — 7	+ ¼	6 1 5
Do. 5 % Pref.	5	5	5	5 — 5¼	..	4 15 3
Calgary Power, 1st Mort. Bds.	100	5	5	92½ — 94½	..	5 5 8
Canadian Gen. El. Com.	$100	7	7†	116 —120	..	5 16 8
Do. 7 % Pref.	$100	7	7	117 —121	..	5 15 8
Cordoba Lt., Power and T., Ord.	1	3	3†	¾ — 1	..	3 0 0
Do. 5 % Deb.	100	5	..	95 — 98	..	5 2 0
Elec. Lt. and P. of Cochabamba, 6 % Bonds	100	6	6	91 — 93	..	6 9 0
Elec. Supply Victoria, 5 % 1st Mort. Deb.	100	5	5	83 — 86	..	5 16 3
Elec. Dev. Ontario, 5 % 1st Mort. Bonds	$500	5	5	95 — 97	+1	5 3 1
Kalgoorlie Elec. P. and L., Ord.	10/-	Nil	..	3/16 — 4/16	..	Nil
Do. 6 % Pref.	1	6	6	5/16 — 6/16	..	8 0 0
Kaministiquia Power, 5 % G. Bs.	$500	5	5	103 —105	..	4 15 3
Madras, Ord.	5	..	..	2⅜ — 3⅛	..	..
Melbourne, 5 % 1st Mort. Deb.	100	5	5	101 —103	..	4 17 1
Mexican El. Lt., 5 % 1st M. Bds.	..	5	5	86 — 87	−1½	5 14 11
Mexican Lt. & Power, Common	$100	4	4†	85 — 87	..	4 12 0
Do. 7 % Cum. Pref.	$100	7	7	106½ —108½	..	6 9 0
Do. 5 % 1st Mort. Gold Bds.	..	5	5	94½ — 96½	− ½	5 3 8
Monterey Rly. Light & Power, 5 % 1st Mort. Deb.	100	5	5	89 — 91	− ½	5 9 11
Montreal, Lt., H. and Power	$100	7	8	193 —198	..	8 9 4
Northern, Lt., Power and Coal, 5 % 1st Mort. Bonds	$500	5	..	39 — 41	..	12 2 10
River Plate, Ord.	Stock	10	..	250 —260	..	3 16 11
Do. 6 % Non-Cum. Pref.	Do.	6	6	110 —115	..	5 4 4
Do. 5 % Deb. Stock	Do.	5	5	100½ —102½	..	4 17 7
Roy. Elec. Co., Montreal, 4½ % 1st Mort. Deb.	100	4½	4½	100 —102	..	4 8 8
Shawinigan Water, Capital	$100	4	5†	131 —133	+5½	3 15 2
Do. 5 % Con. 1st Mort. Bonds	$500	5	5	107 —109	..	4 11 9
Do. 4½ % Per. Deb.	Stock	4½	4½	103 —105	..	4 5 9
Toronto Power, 4½ % Deb.	Do.	4½	4½	99½ —101½	..	4 8 8
Vera Cruz Lt., P. and T., 5 % 1st Mort. Deb.	100	5	5	92½ — 94½	..	5 5 10
Victoria Falls Power, Pref.	1	Nil	11½d.	1⅛ — 1⅜	..	..
West Kootenay Power and Lt., 1st Mort. 6 % Gold	100	6	6	107 —109	..	5 10 1

TELEGRAPH AND TELEPHONE COMPANIES.

Amazon Telegraph	10	Nil	4†	7½ — 7⅝	..	..
Do. 5 % Deb. Red.	Stock	5	5	97 — 99	..	5 1 0
American Telep. & Teleg., Cap.	$100	8	8†	144 —146	+1½	5 9 7
Do. Collat. Trust	£1000	4	4	93½ — 95½	+ ½	4 3 9
Anglo-American Telegraph	Stock	8⅜	8	66 — 68	..	4 8 6
Do. 6 % Pref.	Do.	6	6	109½ —110½	..	5 8 4
Do. Def.	Do.	80/-	80/-	25⅜ — 25⅝	+ ⅛	5 16 0
Anglo-Portuguese Tel., 5 % Mort. Deb.	100	5	5	102 —104	..	4 16 1
Chili Telephone	5	7	..	7⅛ — 7⅓	..	4 13 4
Commercial Cable, Stlg. 4% Deb.	Stock	4	4	86 — 88	..	4 10 11
Cuba Telegraph	10	6	6†	10½ — 11½	..	5 6 8
Do. 10 % Pref.	10	10	10	17 — 18	..	5 11 1
Direct Spanish Telegraph, Ord.	5	4	4†	3½ — 3⅝	..	5 6 8
Do. 10 % Cum. Pref.	5	10	10	8 — 8½	..	5 17 8
Do. 4½ % Debs.	50	4½	4½	99 —101	..	4 9 1
Direct United States Cable	10	4½	..	7⅛ — 8	..	5 12 6
Direct W. India Cable, 4½ % Reg. Deb.	100	4½	4½	99 —101	..	4 9 1
Eastern Telegraph, Ord. Stock	Stock	7	5†	137 —143	+1	5 0 0
Do. 3½ % Pref. Stock	Do.	3½	3½	83 — 85	..	4 2 4
Do. 4 % Mort. Deb.	Do.	4	4	100 —102	..	3 18 5
Eastern Extension	10	7	5†	13⅞ — 13⅞	+ ⅛	5 0 11
Do. 4 % Deb.	Stock	4	4	99 —101	..	3 19 3
East and S. Africa Tel. 4 % Mt. Db. Mauritius Sub.	25	4	4	99 —101	..	3 19 3
Globe Telegraph and Trust	10	5⅞	6†	11 — 11⅞	..	5 2 2
Do. 6 % Pref.	10	6	6	13⅛ — 13⅝	..	4 8 1
Great Northern Telegraph	10	18	5†	32 — 33	..	5 9 1
Indo-European Telegraph	25	13	5†	56½ — 58½	..	5 10 2
Mackay Companies Common	$100	5	5†	81 — 83	+ 1	6 0 6
Do. 4 % Cum. Pref.	$100	4	4	70 — 73	..	5 9 7
Marconi's Wireless Telegraph	1	5	..	4⅞ — 4 15/16	+ 1/16	..
Do. 7 % Cum. Partic. Pref.	1	16	..	3 15/16 — 4 1/16	+ 1/16	..
Monte Video Telephone, Ord.	1	6	6	1 — 1⅛	..	5 6 3
Do. 5 % Pref.	1	5	5	⅞ — 1	..	5 6 8
National Telephone, Pref.	Stock	6	6†	99½ —102½	..	5 17 1
Do. Def.	Do.	6	6†	121 —123	+1	4 17 7
Do. 6 % Cum. 1st Pref.	10	6	6	9¼ — 10	..	6 0 0
Do. 6 % Cum. 2nd Pref.	10	6	6	9¼ — 10	..	6 0 0
Do. 5 % Non-cum. 3rd Pref.	5	5	5	5 1/16 — 5 1/16	..	4 12 0
New York Telep., 4½ % Gen. Bnds.	100	4½	4½	103 —104	..	4 6 6
Oriental Telep. and Elec.	1	8	..	1⅜ — 1½	+ 1/16	4 11 5
Do. 6 % Cum. Pref.	1	6	6	1½ — 1⅝	— ⅛	4 16 10
Do. 4 % Red. Deb.	Stock	4	4	87½ — 89½	..	4 9 5
Pacific and European Tel., 4 % Guar. Debs.	Do.	4	4	98½ —100½	..	3 19 7
Reuter's	8	5	5†	10½ — 11½	+ ½	3 9 7
Submarine Cables Trust	Cert.	6	6	180 —183	..	4 10 8
Telephone Co. of Egypt, 4½ % Deb. Red.	Stock	4½	4½	99 —101	..	4 9 1
United River Plate Telephone	5	8	8	7⅜ — 7⅝	..	5 4 11
Do. 5 % Cum. Pref.	5	5	5	5⅜ — 5⅝	..	4 8 11
West Coast of America	2½	2½	2½	1⅛ — 1⅜	..	3 11 5
Do. 4 % Debs., 1 to 1,500 guar. by Braz. Sub. Tel.	100	4	4	98 —100	..	4 0 0
West India and Panama Teleg.	10	1½	1½†	4⅛ — 4⅜	— ⅛	..
Do. 6 % Cum. 1st Pref.	10	6	6	10½ — 11½	..	5 7 10
Do. 6 % Cum. 2nd Pref.	10	6	6	9⅜ — 10⅜	..	5 6 8
Do. 5 % Debs.	100	5	5	102 —104	..	4 16 2
Western Telegraph, Ltd.	10	7	6†	13⅜ — 14	..	5 0 0
Do. 4 % Deb.	Stock	4	4	99 —101	..	3 19 3
Western Union Tel., 4% Bnds. A	$1000	4	4	106 —109	..	3 18 5
Do. 4½ % Fdg. Bonds	$1000	4½	4½	101 —104	..	4 6 7

* Unless otherwise stated, all shares are fully paid. † Interim dividend.

Continued on next page

SHARE LIST OF ELECTRICAL COMPANIES.—(*Continued.*)

ELECTRIC RAILWAYS AND TRAMWAYS.—HOME.

NAME.	Stock or Share.	Dividends for 1910.	Dividends for 1911.	Closing Quotations Feb. 20th.	Rise + or Fall —	Present Yield p.c. £ s. d.
Bath Trams, Pref. Ord.	1	Nil	Nil	⅛ — ⅝	..	Nil
Do. 5 % Pref.	1	5	5	7/16 — 11/16	..	7 5 6
Do. 4½ % Deb.	100	4½	4½	80 — 85	..	5 5 11
Brit. Elec. Trac., 6 % Pref.	100	..	..	14 — 16	+1½	..
Do. Do. Deferred	100	..	..	8 — 10	..	..
Do. Do. 6 % Cum. Pr'f.	100	..	..	92 — 94	+2	..
Do. 7 % Non-Cum. Pr'f.	100	..	..	41 — 43	+3½	..
Do. 5 % Perp. Deb.	100	5	5	96 — 99	..	5 1 0
Do. 4½ % 2nd Deb.	100	4½	4½	79 — 83	..	5 8 5
Central London Railway, Ord.	100	3	3	69 — 71 xd	—1½	4 4 6
Do. Pref.	100	4	4	83 — 85 xd	..	4 14 2
Do. Def.	100	2	2	58 — 60 xd	—2	3 6 8
Do. 4 % Deb.	100	4	4	100 —102	..	3 18 5
City & South London, Ord.	100	1½	1⅝†	32 — 33	+¼	4 10 11
Do. 5 % Pref., 1891	100	5	5	106 —108	..	4 12 7
Do. Do. 1896	100	5	5	102 —104	..	4 16 2
Do. Do. 1901	100	5	5	101 —103	..	4 17 1
Do. Do. 1908	100	5	5	101 —103	..	4 17 1
Do. 4 % Deb.	100	4	4	101 —103	..	3 17 8
Dublin United Trams, 6 % Pref.	10	6	6	10⅜ — 11⅜xd	..	5 2 2
Great Northern & City, Pr'f. Ord	10	Nil	..	1⅛ — 1⅜	— ⅛	Nil
Hastings Trams, 6 % Pref.	5	Nil	3†	3/16 — ¼	..	..
Do. 4½ % Deb.	100	4½	4½	73 — 78	..	5 15 5
Isle of Thanet Trams, 5 % Pref.	5	2½	2½	2⅜ — 2⅝	..	4 6 11
Do. 4 % Deb.	100	4	4	75 — 80	..	5 0 0
Lancashire United, 5 % Deb.	100	5	5	81 — 83	+1	6 0 6
London Elec. Railw'ys, 4 % Deb.	100	4	4	97 — 99	..	4 0 10
London United Trams, 5 % Pref.	10	Nil	..	3⅜ — 4⅛	— ⅛	..
Do. 4 % Deb.	100	4	4	75 — 78	..	5 2 7
Metropolitan Railway Consol.	100	1⅜	1⅝	46½ — 47 xd	— ½	3 19 9
Do. Surplus Lands	100	2⅜	2⅝	68 — 70 xd	+1½	3 18 7
Do. 3½ % Deb.	100	3½	3½	90 — 92	..	3 16 1
Do. 3½ % Pref.	100	3½	3½	85 — 87 xd	+ ⅜	4 0 6
Do. 3½ % Con. Pref.	100	3½	3½	84 — 86 xd	+ ⅜	4 1 5
Metropolitan District Ord.	100	Nil	..	33½ — 34	— ⅞	Nil
Do. 6 % Deb.	100	6	6	144 —146	..	4 2 2
Do. 4 % Deb.	100	4	4	96 — 98	+1	4 1 8
Do. 4 % Prior Lien	100	4	4	100 —102	..	3 18 5
Do. 4½ % First Pref.	100	4½	4½	89 — 91 xd	..	4 18 11
Do. 3½ % Gtd.	100	3½	3½	76 — 78	+1	4 9 9
Metropolitan Elec. Trams, Ord.	1	5⅛	5†	2 7/16 — 3 1/16	..	5 13 6
Do. Def.	1	Nil	..	3/32 — 5/32	— 1/32	Nil
Do. 5 % Pref.	1	5	5	3/32 — 5/32	..	5 10 2
Do. 4½ % Deb.	100	4½	4½	99 —101	..	4 9 1
Do. 5 % Deb.	100	5	5	100½—102½	..	4 17 7
Potteries, Ord.	1	2	..	1/16 — 3/16	+ 1/16	..
Do. 5 % Pref.	1	5	5	7/16 — 9/16xd	..	6 19 8
Do. 4½ % Deb.	100	4½	4½	89 — 92	—1	4 17 10
South Metro. Trams, 6 % Pref.	1	6	..	⅜ — ½	..	6 17 2
Do. 4 % Deb.	100	4	4	72 — 77	..	5 4 0
Underground Elec. Railways	10	..	..	2⅜ — 2⅝	— ⅛	..
Do. 4½ % Bonds	100	4½	4½	99 —101	..	4 9 1
Do. 6 % Income	100	1	1⅛†	74 — 76	—2	..
Yorkshire (West Riding), Ord.	5	Nil	..	⅛ — ¼	..	Nil
Do. 6 % Pref.	5	Nil	..	2¾ — 3¼	..	Nil
Do. 4½ % Deb.	100	4½	4½	81 — 85	..	5 5 11

ELECTRICAL RAILWAYS AND TRAMWAYS.—COLONIAL AND FOREIGN.

Anglo-Arg. Trams, 1st Pref.	5	5	5⅛	5 — 5⅛	— ⅛	5 4 9
Do. 2nd Pref.	5	5	5⅛	4⅞ — 5 1/16	..	5 3 6
Do. 4 % Deb.	100	4	4	93½ — 95	— ½	4 4 3
Do. 4½ % Deb.	100	4½	4½	101 —103	..	4 7 5
Do. 5 % Deb.	100	5	5	103½—105½	+1½	4 14 9
Auckland Trams, 5 % Deb.	100	5	5	102 —105	..	4 15 3
Bombay Elec. S. & Trams, Pref.	10	6	6	10⅝ — 11⅛	..	5 7 10
Do. 4½ % Deb.	100	4½	4½	98 —100	+2	4 10 0
Do. 5 % 2nd Deb.	100	5	5	98 —100	..	5 0 0
Brisbane Trams Invs., Ord.	5	8	8†	8⅛ — 9	..	4 8 11
Do. 5 % Pref.	5	5	5	4⅞ — 5⅛	..	4 15 3
Do. 4½ % Deb.	100	4½	4½	100 —103	..	4 7 5
B. Columbia Elec. Rly., Def.	100	8	8†	136 —141	..	5 13 0
Do. Pref. Ord.	100	6	6	117 —121	+1	4 19 2
Do. 5 % Pref.	100	5	5	108½—111½	+ ½	4 9 8
Do. 4½ % 1st Mort. Deb.	40	4½	4½	100 —103	..	4 7 5
Do. 4½ % Vancouver Deb.	100	4½	4½	102 —104	..	4 6 7
Do. 4½ % Con. Deb.	100	4½	4½	103 —105	+2	4 5 9
Calcutta Trams, Ord.	5	6	..	5⅛ — 5⅜	..	5 4 4
Do. 5 % Pref.	5	5	5	5 — 5⅛	..	4 15 3
Do. 4½ % Deb.	100	4½	4½	100 —103	..	4 7 5
Cape Electric Trams	1	Nil	2½†	3/16 — ¼	..	..
City Buenos Aires Trams (1904)	5	5	5	5⅛ — 5⅜	..	4 5 1
Do. 4 % Deb.	100	5	5	101 — 103	+5⅛	4 17 3
Colombo Elec. Tr. & Lt., 5 % Deb.	100	5	5	93 — 98	..	5 2 0
Havana Elec. Rly., 5 % Bonds	$1000	5	5	100 —103	..	4 17 1
Kalgoorlie Elec. Trams	1	Nil	..	7/16 — 9/16	..	Nil
Do. 5 % A Deb.	100	5	5	91 — 94	..	5 6 5
Do. 6 % B Deb.	100	5	6†	58 — 62	..	8 1 4
La Plata Elec. Trms, Ord.	1	..	..	21/32 — 25/32	..	..
Do. Pref.	1	6	6	7/8 — 1	..	6 0 0
Lisbon Elec. Trams, Ord.	1	5½	6†	1 — 1⅛	..	4 8 0
Do. 6 % Pref.	1	6	6	1 — 1⅛	..	4 16 0
Do. 5 % Deb.	100	5	5	93½ — 97½	..	5 2 7
Madras Elec. Tr. (1904), Deb.	100	5	5	93½ — 96½	..	5 3 8
Manaos Trams & Lt., 1st Deb.	100	5	5	92 — 95	+ ½	5 5 3
Manila Elec. R. and Ltg., Bonds	$1000	5	5	98½—100½ xd	..	4 19 6
Mexico Trams Com.	$100	7	7†	120 —122	—1	5 14 9
Do. Gen. Con. 5 % Bonds	..	5	5	100½—102½	—½	4 17 7
Do. 6 % Bonds	100	6	6	101 —103	..	5 16 6
Para Elec. Rlys. & Lt., Ord.	5	10	10†	7⅛ — 7⅜	— 1/16	6 13 4
Do. 6 % Pref.	5	6	6	5 — 5⅛	..	5 9 1
Do. 5 % 1st Deb.	100	5	5	97½ — 99½	..	5 0 6
Perth (W.A.) Elec. Tr., Ord.	1	2½	..	1⅛ — 1⅜	..	1 15 7
Do. 5 % 1st. Deb.	100	5	5	100—102	+1	4 18 0
Rangoon El. Tr. & Sup., Pref.	5	6	6	5⅜ — 5⅞	..	5 2 2
Do. 4½ % 1st Deb.	100	4½	4½	98 —101	..	4 9 1
Rio de Janeiro Trams	$100	4½	5†	116½—117½	+1½	4 5 3
Do. 1st Mort. 5 % Bonds	..	5	5	101½—102½	+ ½	4 17 0
Do. 5 % Mort. Bonds	100	5	5	98⅝ — 99⅝	+ ⅛	5 0 3
Sao Paulo Tram, Lt. and P.	$100	10	10†	197 —199	+2	5 0 6
Do. 5 % 1st Deb.	$500	5	5	102 —104	..	4 16 2
Singapore Trams, 5 % Deb.	100	5	5	81 — 84	..	5 19 1
Southern El. Tr. B.A., 5 % Deb.	100	5	5	93 — 95	..	5 5 3
Un. Elec. Trams Monte Video	5	6	7	5½ — 5⅝	+ ⅛	5 6 8
Do. 6 % Pref.	5	6	6	5⅜ — 5⅝	..	5 11 7
Do. 5 % 1st Deb.	100	5	5	98½—101½	..	4 18 6
Winnipeg Elec. Rly., 4½ % Deb.	100	4½	4½	104 —106	..	4 4 11

MANUFACTURING COMPANIES.

Aron, Ord.	1	Nil	6	3/16 — ¼	..	..
Do. 6 % Pref.	1	9	6	2⅜ — 2⅝	..	7 2 2
Babcock & Wilcox	1	26	24†	6⅝ — 6¾	+ 5/16	3 14 11
Do. Pref.	1	6	6	1⅛ — 1⅜	..	3 13 10
B.I. & Helsby Cables	5	10	8†	6¾ — 7⅛	+ ⅜	6 17 11
Do. Pref.	5	6	6	5⅞ — 6⅛	..	4 16 0
Do. Deb.	100	4½	4½	101 —103	..	4 7 5
British Thomson-Houston, Deb.	100	4½	4½	94 — 97	..	4 12 9
British Westinghouse, Pref.	8	Nil	..	⅛ — ¼	..	Nil
Do. Deb.	100	4	4	61 — 64	+¼	6 5 0
Do. 6 % Prior Lien	100	6	6	102 —105	..	5 14 3
Browett, Lindley, Ord.	1	Nil	..	1/6 — 2/-	..	Nil
Do. Pref.	1	Nil	..	5/- — 6/-	..	Nil
Brush, Ord.	2	Nil	..	0 — ¼	..	Nil
Do. 7 % Pref.	2	Nil	..	0 — ¼	..	Nil
Do. 4½ % Deb.	100	4½	4½	56 — 61	..	7 7 7
Do. 4½ % Second Deb.	100	4½	4½	37 — 42	..	10 14 4
Callender's Cable	5	15	10†	9 — 9⅜	..	7 13 10
Do. Pref.	5	5	5	5 — 5⅛	..	4 15 3
Do. Deb.	100	4½	4½	98⅞—100⅞	..	4 9 7
Castner-Kellner	1	17½	20	3⅝ — 3¾	— 1/16	5 10 4
Do. Deb.	100	4½	4½	106 —110 xd	..	4 1 10
Crompton & Co.	3	Nil	Nil	⅛ — ⅜	..	Nil
Do. Deb.	100	5	5	58 — 68	..	7 7 1
Dick, Kerr	1	5	..	3⅞ — 4⅛	..	5 3 1
Do. Pref.	1	6	6	5⅝ — 1 3/32	+ 1/32	5 9 9
Do. Deb.	100	4½	4½	98 —101	..	4 9 1
Edison & Swan, A, £3 paid	5	Nil	..	1/16 — 1/8	..	Nil
Do. fully paid	5	Nil	..	1/8 — 2/16	..	Nil
Do. 4 % Deb.	100	4	4	71 — 75	..	5 6 8
Do. 5 % Second Deb.	100	5	5	77 — 80	..	6 5 0
Electric Construction	2	Nil	2½†	3/16 — ¼	..	..
Do. Pref.	2	7	7	1⅝ — 1⅞	..	7 9 4
Greenwood & Batley, Pref.	10	7	7	7½ — 8½	..	8 5 8
Do. Deb.	100	5	5	94 — 96	..	5 4 2
General Electric, Pref.	10	5	5	9 — 9⅛	..	5 5 3
Do. Deb.	100	4	4	85 — 90	..	4 8 11
Henley's, Ord.	5	15	10†	11⅝ — 12½	..	6 2 5
Do. Pref.	5	4½	4½	4 1/16 — 5 1/16	..	4 5 11
Do. Deb.	100	4½	4½	104 —106	..	4 4 11
India-Rubber, G. & T.	10	10	..	10 — 12	..	..
Do. Pref.	10	5	5	9½ — 10½	..	4 17 7
Telegraph Construction	12	20	10†	85½ — 87½	..	6 7 0
Do. Deb.	100	4	4	99½—101½	..	3 18 10
Willans & Robinson	1	Nil	..	⅛ — ¼	..	Nil
Do. Pref.	5	Nil	..	1 — 1⅛	..	Nil
Do. Deb.	100	4	4	59 — 62	+5	6 9 1

* Unless otherwise stated, all shares are fully paid. † Interim dividend.

The yields are calculated in most cases upon the dividends paid for 1910.

Bank rate of Discount 3½ per cent., February 8th, 1912.

NOTES ON RHEOSTATS.

By "B. K."

The following notes are based on the results of considerable practical experience in the design, testing and operation of almost every type of rheostat, and, it is hoped, may be of some interest, both to those engaged in their manufacture and also to the far larger number who are either buying or using rheostats of one form or another.

At the outset it may be said that in spite of the subject having of late received considerably more attention, there are still many cases where, through insufficient care having been given to the selection of rheostats *suitable for their work*, much loss of time and money has been involved. Indeed, it is not too much to say that the successful working of many industrial plants depends largely on the type of rheostats and control gear adopted.

In view, therefore, of its importance in the above connection, it is proposed first to consider the question of :—

Rating.—On looking through makers' catalogues we may see that certain rheostats are guaranteed to start against 50 per cent. overload—which at first sight appears quite sufficient for ordinary service. It will be noticed, however, that the temperature rise, and in many cases the time of starting, is carefully omitted. It will be obvious that almost *any* rheostat would start a motor against 50 per cent. overload if the time of starting were sufficiently short—but it would be found that under normal conditions (and, unfortunately, sometimes abnormal) such a rheostat, having a very short time rating, would very soon break down. It is therefore important that the time rating should be ample and the temperature rise reasonable, while the permissible time between successive starts should be clearly stated. In general, no starter should have less than a 30-second rating, while the one-minute type is in many cases desirable even for small motors.

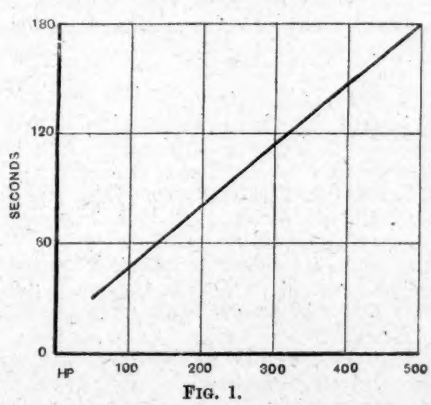


Fig. 1.

The curve in fig. 1 gives suitable approximate values to assume for the starting period, to serve as a basis for calculation, special cases, of course, being treated individually.

The temperature rise may vary from 200° F. to 500° F., and what constitutes a safe limit depends largely on the nature of the resistance, this subject being discussed later.

It may here be worth while mentioning that where a manufacturer speaks of a two-minute, five-minute, &c., rating it is generally understood to mean that it is permissible to take a period of two or five minutes in moving from the "off" to the "full on" position, and *not* as is sometimes inferred—that one may remain two or five minutes on the first step.

In certain types of rheostats—namely, liquid and some embedded types—the system of horse-power minute rating should be used, and this also serves to check roughly at sight the suitability of a given starter for its work. The horse-power-minute capacity may be defined as the product of rated H.P. of motor × starting time in minutes × ratio of starting to full-load torque, this figure generally being taken for some definite period—thus, H.P.-minutes per half-hour—the latter quantity being the time allowed for cooling. If starting is performed infrequently, obviously the above figure may be increased; for instance, in liquid starters the H.P.-minutes per half-hour value may be doubled where the interval between starts is of the order of three to nine hours, depending on the size.

The next point to be considered is the question of current increments, and the following table, which it is believed has not been published hitherto, will be found useful. Incidentally it illustrates the absurdity of certain specifications which demand increments of 10 per cent., and even 5 per cent. per step.

Values of constant "C" = Ratio $\frac{\text{Momentary rush}}{\text{Full-load current}}$ when starting under full load.

	No. of sections of resistance.															
% C^2R in arm.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	Approx. H.P.
1·75	15·01	7·59	3·9	2·75	2·24	1·97	1·79	1·66	1·57	1·50	1·45	1·40	1·37	1·34	1·31	100
2·0	14·8	7·14	3·71	2·67	2·19	1·92	1·76	1·63	1·55	1·48	1·43	1·38	1·35	1·32	1·29	50
2·5	14·5	6·4	3·44	2·52	2·10	1·85	1·69	1·59	1·51	1·45	1·40	1·36	1·33	1·30	1·28	15
3·0	14·2	5·86	3·27	2·42	2·03	1·8	1·66	1·55	1·48	1·42	1·37	1·34	1·31	1·288	1·265	7½
3·5	14·03	5·45	3·09	2·34	1·98	1·76	1·63	1·53	1·46	1·40	1·35	1·33	1·29	1·27	1·25	5
4·0	13·8	5·13	2·95	2·26	1·92	1·72	1·59	1·50	1·43	1·38	1·34	1·31	1·28	1·26	1·24	3
4·5	13·7	4·8	2·84	2·19	1·87	1·69	1·56	1·48	1·42	1·37	1·33	1·29	1·27	1·25	1·23	2
5·0	13·6	4·57	2·75	2·13	1·84	1·66	1·54	1·46	1·40	1·355	1·318	1·29	1·27	1·24	1·22	1
6·0	13·3	4·21	2·6	2·05	1·78	1·61	1·50	1·43	1·37	1·33	1·30	1·27	1·25	1·23	1·21	½

Note.—The values given above for a single section of resistance would never be approached in practice, and in no case would the current rush quite attain the above values.

Incidentally it illustrates the absurdity of certain specifications which demand increments of 10 per cent., and even 5 per cent. per step.

The fallacy of allowing, say, 10 per cent. of normal on the first step of a 13-contact starter is apparent, as by the time full-load current is reached, the number of steps available for starting proper will be so small that current rushes of 200 to 300 per cent. will take place. The table also will be found useful in considering starters of the multiple solenoid or lever type for large motors, where usually the number of sections employed is small. Owing to self-induction, the actual current rushes will always be rather less than the table shows, and this point should be borne in mind.

Intimately connected with the above is the question of voltage drop between contacts, this being in many rheostats at present on the market much too high. Theoretically, the voltage-drop should be below that at which arcing is set up, but as this would mean a large number of contacts, a higher value has to be employed. This should on a sliding-contact starter not exceed from 60 to 70 volts even on the higher voltages, and lower values are desirable, in order to avoid too rapid wear of the main or auxiliary contacts.

To comply with the above it will be found necessary to depart from the geometric rating, and somewhat increase the value of the resistance sections on the later steps, and this in practice is found to cause no trouble, although, of course, the larger the number of active contacts the more perfect the possible grading.

The next point we will consider is the construction of D.C. starting rheostats—first as regards their switch portion, and later the resistance. The faceplate or sliding-contact type is in general use for horse-powers up to 50; it is also used

to some extent between 50 and 100 H.P., but is not to be recommended for such powers except in special cases. Slate or marble is frequently used; although it is cheap, the former is low in insulation, and would probably not be used if a more robust form of construction could be cheaply produced.

Where slate is used it should always be treated; this "special treatment," so described by the makers, generally merely consists of boiling in paraffin wax. The metal and mica construction, as specified by the British Admiralty for ship use, is excellent when properly carried out, but in general is too expensive for ordinary service.

The contacts should always be easily renewable from the front, and auxiliary roller contacts of carbon are very desirable on starters which are subject to frequent and arduous service. The gap between adjacent segments should be as wide as possible, consistent with not allowing the contact brush to become wedged in it. It is desirable that both a main and a shunt sector be fitted, thus preventing any necessity to depend on the hub for current carrying and ensuring a constant full field during starting. The practice of barring the first contact to the spool cheek is to be deprecated, and the provision of a field-full-on button, or better still, a shunt sector as above, is much to be preferred. The advisability of providing an overload device on the starter is questionable. The average overload soon either gets tied down, or if left alone fails to make sufficiently good contact to short-circuit the no-volt coil properly, and hence in time of emergency fails to act, and the motor if unprotected by suitable fuses may burn out.

The very best practice is to interlock the hand-operated starter with a separate circuit-breaker—the overload device being arranged to *open* the circuit of the operating coil, thus giving a much greater certainty of action than by relying on a possibly bad contact by partially *short*-circuiting.

Where a spiral hub spring is fitted, care should be taken to see that the angle of twist is not too great, and some provision for adjustment of tension is essential, as after a certain amount of use the springs become weaker, and fail to retract the starting arm.

Terminals should be of ample size. Some manufacturers apparently assume that their customers will be using cables at about 5,000 amps. per sq. in., instead of 1,000, even the latter figure being, of course, too high for large cables.

The question of protection and covers is now receiving considerable attention, and one point may well be mentioned in this connection. In many semi and totally enclosed starters, it is impossible for the operator to see whether he is squarely on a contact segment, or merely touching, perhaps, on a line, the next segment in addition.

In the latter case, since the greater part of the current naturally goes through the later contact, severe local burning is set up, and in a very short time the contacts require cleaning or replacing. This clearly points to putting this possibility beyond the control of the operator, which may be ensured by the fitting of an auxiliary operating gear giving a step-by-step motion quickly and squarely on to each contact. In at least one type of this gear it is possible for the correct movement to be given at the beginning of the travel, while later on the contact arm may have advanced or slipped, thus giving rise to the very trouble this gear was designed to avoid. This point should therefore have attention.

The resistance next claims consideration, and upon its suitability the utility, or otherwise, of the complete starter largely depends.

Of the materials used, iron should be unhesitatingly rejected, its only virtue being its cheapness. Various coatings have been tried, but though they are more or less effective at first, it is usually only a matter of time for corrosion to set in.

The various alloys such as Eureka, Ferry, &c., are excellent, and are accepted by the Admiralty when wound in a specified manner. Open spirals, though giving good ventilation, are liable to short, while the practice of using asbestos tubes cannot be considered good. Asbestos is by its very nature weak mechanically, a poor insulator and very hygroscopic—three qualities which do not render it particularly suitable for this work. There is little doubt that the ideal form of resistance, where wire must be used, is the unit form, and one type in particular has been developed to a great degree of perfection, and is now specified by the British Admiralty. Resistance units should be interchangeable and readily renewable in case of replacement being necessary.

Much has been said in praise of carbon type resistances, but the fact remains that they are, in general, used to a very small extent compared with the ordinary type of resistance, and after spending a considerable amount of money in experiments, several important firms have found good reason to decide against their manufacture.

Where possible, there is no doubt the grid resistance is the most satisfactory form; but even in this case there are several important points which require attention.

Cast-iron as generally employed should either be coppered or coated with a special heat-resisting graphite or aluminium paint, and the surfaces where contact is made at the lugs should be coppered or tinned, the latter being specified by the Admiralty.

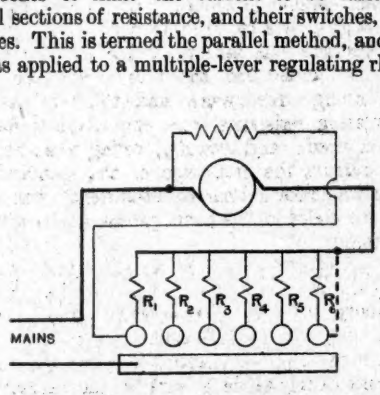
Cast-iron also suffers from the disadvantage of increasing its resistance with temperature. This increase depends on the temperature rise and composition of the iron. A usual figure is from 12 to 25 per cent. for average temperature rises.

Where frames of resistance grids are mounted one above the other, it is necessary to reduce the rating to allow for the air impinging on the upper grids being already heated from the lower banks; the following figures show the necessary reduction in the rating for various numbers of frames:—

Number of frames.	*Rating.*
1	1
2	·8
3	·67
4	·6
5	·54

Where heavy currents are to be carried continuously, the type of terminal used should be of ample size and substantial construction.

Mention may here be made of a method of connection for heavy currents to limit the current to be carried by the individual sections of resistance, and their switches, to reasonable figures. This is termed the parallel method, and is shown in fig. 2 as applied to a multiple-lever regulating rheostat.



R_6 is omitted and dotted connection inserted when used for starting.

FIG. 2.

It will be seen that the method consists of successively putting sections of resistance *in parallel* with each other instead of the more usual method of cutting *out of series*. This will be found to effect a considerable saving on large multiple-switch type starters, and, it is believed, is not generally appreciated at its true value.

In conclusion, it is proposed to indicate briefly one or two of the faults and troubles which are common to most rheostats—often, be it said, not due to any inherent defect in the design of the starter.

Troubles on Starting Gear.—The lot of the particular individual at a large works whose duty it is to clear up the inevitable complaints which must arise from time to time is not a happy one. This is largely due to two classes of user—(1) The man who cannot appreciate that there ever should be any reason for, say, a burn-out, and (2) the man who, while knowing full well that the cause of a breakdown is his own improper usage, yet tries to fix all the blame on the makers of the rheostat.

The most common trouble is, perhaps, burning-out or failure of the resistance portion, and as there is always a

reason for everything, it is of the first importance to find out the actual starting conditions. Although this is often difficult, it is generally worth while, and prevents a repetition of the same trouble. For instance, it may be found that a starter designed for light infrequent starting is being used for the motor driving a printing press, requiring constant "inching," and necessitating the use of the very highest class of starting gear, and a heavily rated resistance. Many instances similar to the above might be quoted, and only serve to emphasise the importance of the remarks under "Rating" above.

A second prolific cause of complaint is the harmless necessary no-volt coil, and here again if the simple precaution of ascertaining the actual maximum and minimum shunt current of the motor with which the starter is to be used, is taken at the time of ordering, there is very little chance of trouble. Where the variation in shunt current is large, the auto-spool is frequently fitted across the lines in series with a high-resistance unit, thus rendering the hold-on unaffected by the varying shunt current. This high-resistance unit is frequently the cause of trouble, and where, for instance, on 500 volts, the use of very fine wire on the unit is necessary to obtain the requisite resistance (2,000 to 3,000 ohms) it is perhaps preferable to use three 8 or 16-c.p. 220-volt lamps in series instead of a unit. The lamps have the decided advantage that they are easily replaced, and give a visible indication when current is on the motor and switchgear.

In connection with troubles with the no-volt coil, it sometimes happens that the starter arm refuses to release when pressure is removed. This is due to residual magnetism (assuming the arm is not mechanically caught) and may be cured by the fitting of a small brass pin in the spool cheek. Of course with really soft iron spool cheeks and armature, this trouble will not occur, but unfortunately *cast*-iron is often used for the cheeks on account of cheapness.

A rather interesting case was that in which a small series regulator was actually found to increase the speed of the motor (a shunt-wound machine) when all resistance was in circuit, although it was required to reduce speed by 30 per cent. The customer was naturally indignant, and, of course, quite failed to understand the true explanation. First, the actual running current was so small that the volts dropped by the regulating resistance were only about a quarter of what was required; and secondly, owing to an abnormally high shunt current, the resistance of the standard no-volt coil fitted (suitable for normal shunt-current), was sufficient to weaken the field to such an extent as to give a net increase in speed.

In addition to the above there are, of course, many little troubles, which must be dealt with individually, but it is hoped the above brief notes may serve to indicate the points to be looked for, and possibly cause one or two people to spend a little longer in the selection of a rheostat than the individual who calmly sends a wire to the nearest maker: "Send one motor-starter passenger train to-day certain," and then grumbles because he is mildly asked for at least the horse-power and voltage.

INDEX TO ARTICLES IN THE TECHNICAL PRESS.

By "INTERESTED."

There is nothing which causes more irritation than looking through piles of technical journals in an endeavour to trace some particular article published a few weeks earlier, which is required for reference. Invariably the issue containing the information sought is missing—some one has borrowed it, or the paper is mislaid; and, after spending perhaps half an hour looking for that which cannot be found off-hand, the telephone is requisitioned for the purpose of worrying different publishers by asking whether a certain article ever appeared in their publications, and, if so, in which number. By the time telephoning is finished the missing paper is found, or a clerk has been round to the local library or to a business friend, and thus obtained what is wanted. This kind of thing is annoying and a waste of time, and the language used on occasions like these is often none too edifying.

A very good idea was recently brought to my notice for overcoming this kind of trouble, and I now put it forward in the hope that other readers will benefit thereby, and perhaps save publishers being worried in order to look up information, instead of receiving an order by telephone to forward a certain copy of a paper by return post straight-away.

The arrangement is simply this: an ordinary loose-leaf book—or any other form of book, for that matter—is ruled over several pages after the following pattern:—

Index to Published Articles.

Subject.	Author.	Date.	Name of journal.	Volume and No.	Tel. No. of publisher.

Left-hand page. Right-hand page.

At any time when one is reading, and an article appeals to the reader as likely to be handy for future reference, a note is made in the book under the headings set out. It has been suggested that a note made in the customary manner in the pocket-book would answer the same purpose, but that is a fallacy. Notes often get misplaced, especially in loose-leaf books, or destroyed or obliterated when made in a hurry with pencil, and you cannot remember how long ago the note was made. On the other hand, when you have taken the trouble to rule-up a few pages after the fashion described above, ostensibly for a single purpose, then the desired particulars can be entered at the time of reading in a spot which is always handy, and where they can always be found for reference later on without delay. It is not forgotten, and a note is not made in some out-of-the-way place in the note-book which afterwards takes a lot of finding. I have given the idea a trial, and feel quite satisfied that it is well worth the little trouble involved in ruling a page or two.

Those firms who kindly send along little pocket-books and diaries about Christmas time, might do worse than have a leaf or two at the end of their books ruled on similar lines to the pattern here illustrated.

PROCEEDINGS OF INSTITUTIONS.

Recent Developments in Steam Turbine Practice.

By K. Baumann.

(*Abstract of paper read before the* Institution of Electrical Engineers, *at Manchester, January 16th*, 1912.)

When the British Westinghouse Co. commenced the building of Rateau turbines in 1908, it had the benefit of experience gained in the building of Parsons turbines, which already had resulted in 1903 in the use of velocity stages in the high-pressure end. The type of Rateau turbines built since 1909 is shown in fig. 1 (p. 318). The steam is admitted to the velocity wheel through nozzles fixed to nozzle boxes of cast steel, which, with the steam chest, are the only parts of the turbine subject to high pressures and high temperatures. The design of the casing and the diaphragms, in halves with only horizontal joints, allows of a very easy inspection and accessibility to the rotor, and to the interior of the turbine by lifting the top half. Due to the use of a velocity wheel, an ordinary laybrinth gland has proved to be quite satisfactory with regard to the leakage of steam, and has the advantage of greatest simplicity and reliability. The high-pressure gland is connected to the exhaust of the turbine, and is sealed against air by the well-known water gland used on the Westinghouse-Parsons turbines, which is also adopted as a low-pressure gland.

The recent development of the various steam turbines shows very clearly the tendency towards the use of the two types known as the disk and drum or Curtis-Parsons type and the Curtis-Rateau type. These must be considered the most important types at present in use, as is best shown by the fact that practically all turbine builders in this country are adopting one or the other. It is not possible to give a definite statement, that in general one is better than the other; this depends on the conditions under which the

turbine is required to work in any particular case. The reliability of the turbine will depend much more on the design of the details than on the principle on which it is constructed.

Dividing turbines into three categories :—

1. Turbines with small outputs—less than 750 KW. at 3,000 R.P.M., or 2,250 KW. at 1,500 R.P.M.

2. Turbines with moderate outputs—750-1,500 KW. at 3,000 R.P.M., or 2,250-4,500 KW. at 1,800 R.P.M.

3. Turbines with large outputs—above 1,500 KW. at 3,000 R.P.M., or 4,500 KW. at 1,500 R.P.M. :—

we can state the relative position to be as follows :—.

For turbines with small outputs the disk and drum type is certainly cheaper, *i.e.*, the disk and drum type can be made at a lower price for the same steam consumption, or allowing the same price for both types, the disk and drum turbine can be made with the better efficiency.

For moderate outputs the two systems are about equal with regard to economy and first cost.

For large outputs, the Curtis-Rateau turbine is the better because the disk and drum type would have to be made as a double-flow turbine, in the low-pressure part, which would increase the cost of the turbine considerably without a corresponding increase in efficiency.

In short, the drum turbine is the design for small outputs ; the disk turbine for large outputs.

The maximum output which can be obtained with a disk turbine, under the same conditions with regard to working stresses, leaving losses and vacuum, is about twice as large as the maximum output which can be obtained with a drum turbine.

The maximum output for which steam turbines can be designed depends on the maximum weight of the steam which can be passed through the low-pressure part with reasonable efficiency. The greater the steam quantity, the greater the output of the turbine.

The specific volume of the steam, and therefore the maximum output which a turbine can be designed to give, depends mainly on the vacuum, and the output is, other conditions remaining the same, about 2·83 times larger at 27 in. than at 29-in. vacuum. In order, therefore, to compare the drum with the disk turbine, as regards maximum output, we must assume the same vacuum for both.

In order to reduce the leaving loss to a minimum, the blading should be so arranged that the absolute outlet velocity from the last wheel is in an axial direction. The maximum output is proportional to the sq. root of the leaving losses. The maximum mean diameter of a turbine depends on the peripheral velocity, which itself is limited by the maximum stresses allowable.

The maximum stress in drums should not exceed one-third of the elastic limit, or about one-fifth of the tensile strength of the material, and hence the mean blade velocity should not exceed 400 ft./sec. for forged steel drums, or 465 ft./sec. for 3 per cent. Ni-steel drums.

The maximum stresses in the case of a plain rotating disk are only 41·25 per cent. of those of a drum rotating at the same peripheral speed ; or, in other words, to obtain the same stresses a plain rotating disk must be run with a peripheral speed 55·5 per cent. higher than that of a rotating ring or drum. Unfortunately disks used for steam turbines must be provided with a hole at the centre for the purpose of fixing them on to the shaft, and the tangential stress near the periphery of the hole is increased to double the stress in a solid disk without a hole. This means that a disk with a very small hole is only very little stronger than a ring rotating with the same peripheral velocity.

A plain disk with a hole in the centre, is not, however, strong enough for turbine work, and it is therefore necessary to increase its strength, by strengthening the disk near the periphery of the hole by a boss, and increasing the thickness of the disk towards the centre in order to obtain as nearly as possible a disk of uniform strength.

Mild steel disks equal in strength to plain disks, as used in practice, can be run at a peripheral velocity of 555 ft./sec., so that for 3,000 R.P.M. the mean diameter would be 42 in., or for 1,500 R.P.M. 84 in.

The maximum steam quantity is proportional to the blade height. As the ratio blade height : mean diameter of last row of blades is generally less that one-fifth, the stress at the root of the blades (for drum turbines) is only half of the stress of the drum. In drum turbines, therefore, the blade height is only dependent upon the reliability of the method employed for fixing the blades to the drum.

There are methods of fixing the blading existing with which no stress is produced in any part larger than that at the root, and since this stress is of no importance, the maximum height of the blades in drum turbines is limited by other considerations ; in order to keep the difference of the peripheral speeds at the root and at the top of the blades within practical limits it is not advisable to increase the blade height above one-fifth of the mean diameter, as already pointed out.

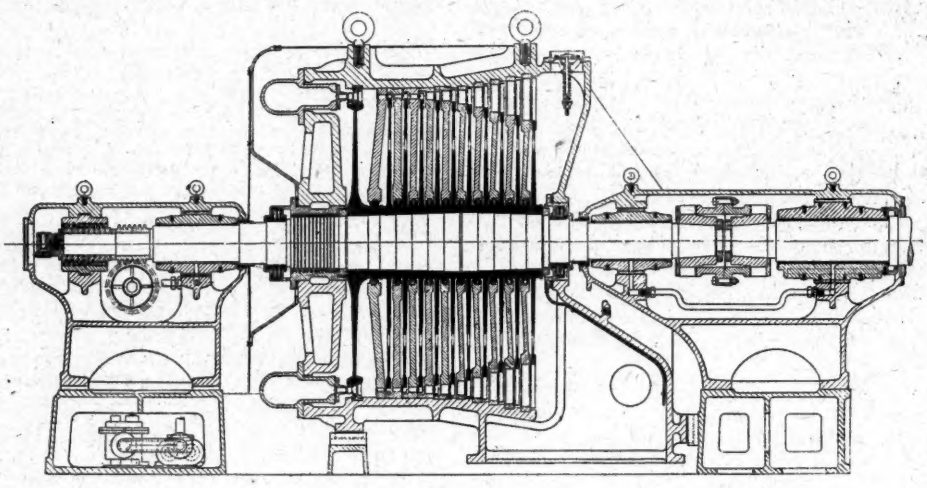


FIG. 1.—MODERN WESTINGHOUSE RATEAU STEAM TURBINE, 1910.

The blade height which can be used in disk turbines is dependent upon the stress at the root of the blade, and taking the maximum blade height of Rateau turbines to be one-fifth of the mean diameter, the maximum output is proportional to the square of the diameter.

For a given number of revolutions of the turbine, the diameter is proportional to the peripheral speed and the output, and for the same stress in disks and drums, other conditions remaining the same, a disk turbine can be built having twice the maximum output of a drum turbine.

The fact that some makers have recently begun to use solid drums, which would theoretically be stressed only to the same figure as disk turbines, does not alter the above statement with regard to relative capacity, because it is unsafe to run solid drums at a higher peripheral speed than ordinary drums. This is due to small faults in their interior which it is quite impossible to detect, and which it has been shown increase the calculated stresses to more than double. Both the disk and the ordinary drum construction have the advantage of allowing inspection to be made of each part, thus ensuring that the material is homogeneous throughout.

The maximum output of a disk turbine, being proportional to the square of the diameter is—for a given permissible stress—inversely proportional to the square of the revolutions per minute.

In practice, however, it is not advisable or necessary to stress the material in large turbines to the same extent as in small turbines, so that the relation between speed and output may be taken as follows :—

Maximum output for 1,500 R.P.M., three times larger than for 3,000 R.P.M. ; for 1,000 R.P.M., five times larger, and for 750 R.P.M., eight times larger than for 3,000 R.P.M.

As the stresses are proportional to the square of the diameter for a given speed, it follows that, other conditions remaining the same, the maximum output is proportional to the tensile strength of the material.

The maximum output is effected in the same way by the decrease of stress obtained by improving the disk and blade shape.

For a given turbine of, say, 42 in. mean diameter, running at 3,000 R.P.M., the maximum output only depends on the vacuum and the leaving losses. The relations between these quantities have been plotted in fig 2 in the calculation of which the following figures were assumed :—

Initial pressure	...	...	= 180 lb./sq. in. gauge.
Superheat	...	...	= 150° F.
Turbine efficiency	...	...	= 70 per cent.
Generator efficiency		...	= 94 per cent.

The question of the maximum outputs which can be obtained with the different types of turbines becomes very important in view of the great increase in the maximum capacities of turbo-alternators during the last three years. This is mainly due to the rapid development of the impulse turbine, the high costs of which for

small outputs and great economy for large outputs have caused the manufacturers of these turbines to introduce designs of turbo-generators suitable of giving very large outputs at relatively high speeds. Whereas four years ago 1,000 KW. was considered a very large output for 3,000 R.P.M., manufacturers are at present prepared to go up to 3,000 KW., and even higher, for this speed. The increase of the output of turbo-alternators has been more rapid in the United States and on the Continent than in this country. For

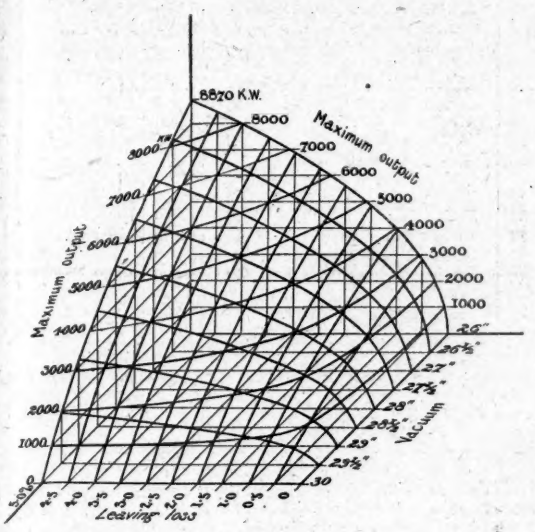


Fig. 2.—Maximum Output Obtainable from Disk Turbines.

example, the American Westinghouse Co. recently built 5,000 K.V.A. running at 3,600 R.P.M., and 15,000 KW. maximum rating at 1,800 R.P.M. The A.E.G. Co. is reported to have in work 15,000 K.V.A. at 1,000 R.P.M., and Siemens-Schuckert works 4,000 K.V.A. at 3,000 R.P.M.

In the design of steam turbines a most important factor is the critical speed of the shaft. In this matter the disk type of turbine has a very considerable advantage over the drum, in that its critical speed can be calculated with ease and certainty.

The first turbines of the Rateau and Zoelly type were made with a flexible shaft, *i.e.*, the normal speed was above the first critical speed. At one time there was even a tendency to neglect the critical speed altogether, as it was found that turbines, if properly balanced, could, under normal conditions, be run very satisfactorily even at the critical speed. Unfortunately, it was soon found in commercial running, when abnormal conditions are bound occasionally to occur, that if the shaft were deflected—as, for instance, when water is carried over with the steam—it remained deflected, because it was running at the critical speed.

The question of the critical speed is of the first importance when using the three-bearing design, which is becoming more generally adopted for small turbines.

The critical speed of a shaft is usually defined as that speed at which a very small eccentric mass will cause the shaft to deflect to a very great extent. It can be demonstrated that this speed coincides with the natural frequency of vibration of the shaft, and also that it is that speed at which any accidental deflection of the shaft results in a centrifugal force due to its rotation about its position at rest, sufficiently large to maintain this deflection.

If only one weight be used there is but one critical speed, and as the speed is raised above this the running becomes steadier. Extensive use of this fact has been made by De Laval in his single-wheel turbine, in which, in order to reduce vibration, the running speed is seven times greater than the critical speed.

If more than one weight be used the shaft will have critical speeds of higher frequency, and in the case of shafts with uniformly distributed loads there are theoretically an infinite number of critical speeds, of which, however, only the first, second, and, in exceptional cases, the third and fourth, are of practical importance.

It is very important to know the second critical speed of shafts running above the first, because it is essential that the running speed be sufficiently removed from both the first and the second, in order to reduce the vibration to a small amount. Also, it is very often impossible to calculate the critical speed with absolute accuracy, and, consequently, it should be made a standard practice to have the running speed at least 30 per cent. above or below any critical speed.

Steam turbines are generally governed by a throttle valve, which is connected to a mechanical governor either directly or indirectly by means of a steam or oil relay.

Direct governing, which has been adopted from steam engine practice, is very satisfactory for small turbines, provided the valves are absolutely balanced; for larger turbines, steam relays with pulsating motion have been used, but now nearly all manufacturers of steam turbines use oil relays, and this is undoubtedly the most satisfactory arrangement. In the case of combined turbines, governing by cutting out nozzles improves the economy at partial loads.

It has been stated that a disadvantage of the combined turbine is that it must be provided with nozzle cut-out governing at partial loads, in order to obtain satisfactory consumption at these loads. This, however, is not so, as there is, of course, no reason why ordinary throttle governing should give less satisfactory results at partial loads with combined turbines than with "pure" types of turbines. Automatic nozzle control complicates the governing mechanism to such an extent that it should only be adopted in exceptional cases, where turbines are run for a considerable length of time at low loads and where the loads may change rapidly. In most cases ordinary throttle governing is preferable, as the small improvements obtainable with nozzle cut-out governing (2 per cent. at ¾ load, 4 to 5 per cent. at ½ load) do not justify the additional complication in the governing apparatus. The practical difficulties of automatic nozzle control are due not to the necessity of arranging valves in front of the nozzles, but to the complicated gear required to operate the valves, which latter must be reasonably tight when closed. These difficulties do not exist when hand-operated valves are used, and in most cases these meet the requirements.

The steam turbine is the machine for large outputs, and it has during the first half of the last decade superseded the steam engine for outputs above 1,000 KW. The recent improvements in steam turbines, which resulted in the adoption of the combined types, have still further reduced the minimum output at which a steam engine is more advantageous than a steam turbine. Units of 500-KW. capacity are now usually ordered as turbines, and even 250-KW. turbines are able to compete successfully with the best modern steam engines. In countries, as, for instance, the United States, where the cost of coal is of secondary importance, there is a tendency to adopt turbines for even the smallest outputs. For small units, generally the pure Curtis types with only a single wheel are used. These are also used very successfully for special purposes, as, for instance, the driving of condenser and high-lift pumps.

The developments which have taken place during the last five years show an improvement not only in high-pressure condensing turbines as used for power stations, but also a tremendous increase in the application of turbines to all possible industrial purposes. This has involved the manufacture of new kinds of machines known as low-pressure, mixed-pressure, back-pressure and reducing turbines.

The great importance of low-pressure turbines was first pointed out by Prof. Rateau, who invented the Rateau steam accumulator, which is really a necessary accessory for low-pressure installations.

The Rateau accumulator allows low-pressure steam at a constant or approximately constant rate to be taken from a machine which is working intermittently. If the available low-pressure steam quantity is always sufficient for the output required, the installation of a low-pressure turbine is quite satisfactory; if for short periods no low-pressure steam is available, high-pressure steam must be reduced and passed into the low-pressure steam main. If, however, this occurs for long periods, or if the low-pressure steam quantity is not sufficient to produce the power required from the turbine, the losses due to throttling high-pressure steam to below atmospheric pressure are too large. In such cases, which represent the normal condition, the installation of a mixed-pressure turbine is necessary.

The main application of low-pressure turbines is at present in connection with steam engines in existing power stations. Engines previously run condensing are changed to run non-condensing, and allowed to exhaust into a low-pressure turbine, the alternator of which is coupled electrically to that on the steam engine, so that engine and turbine form one set.

This arrangement is very economical, providing the normal output of the combined set is increased at least 50 per cent. above that of the engine alone. Usually the combined set is arranged so that the normal full load of the engine alone when exhausting against a back pressure of about 16 lb. per square inch absolute is kept the same as before, the low-pressure turbine utilising the exhaust steam coming from the engine. It is advisable to pass the exhaust steam from the engine through an oil separator, which acts also as a water separator. The additional output which can be obtained from the low-pressure turbine depends mainly on the vacuum. The improvement in economy is much larger in cases where river or sea water is available for cooling water than in cases where cooling towers are necessary. At partial loads the back pressure on the steam engine drops below atmospheric pressure; it is therefore essential to steam-seal the glands on the low-pressure cylinders of the steam engine in order to reduce air leakage to an absolute minimum and to secure the highest possible vacuum.

The following figures are based on the average conditions which usually occur in these combined plants in the case of compound engines.

The steam consumption of the engine running non-condensing will be about 35 per cent. (30 per cent. to 40 per cent.) greater than when running condensing. The exhaust steam from the engines will give an additional output in a low-pressure turbine of:—

61 per cent. of the output of the engine at 27-in. vacuum,
70 „ „ „ „ 28 „ „
81 „ „ „ „ 29 „ „

and the steam or coal consumption would be:—

For 27-in. vacuum: 1·35/1·61 = 84 per cent. of the original steam consumption
„ 28 „ „ 1·35/1·70 = 80 „ „ „
„ 29 „ „ 1·35/1·81 = 75 „ „ „

As the turbine is electrically coupled to the engine, no special governing of the turbine is required. For starting and paralleling generally, high-pressure steam is required, which is either regulated by hand or by a mechanical governor. It is not necessary to provide a reducing valve, as the steam pressure in the low-pressure turbine will not be higher than atmospheric pressure, due to the very large areas through the blading of the turbine.

A low-pressure turbine is simply a high-pressure turbine with the first wheels taken off.

Mixed-pressure turbines are high-pressure turbines with an additional inlet for low-pressure steam, or low-pressure turbines with additional high-pressure stages to utilise high-pressure steam in case the available low-pressure steam quantity is not sufficient for the load required. They are generally used in collieries and rolling mills, utilising low-pressure steam coming from different kinds of engines, which are exhausting against a back pressure of about 16 lb. per sq. in. absolute, through steam accumulators.

A section through a mixed-pressure turbine consisting of one velocity wheel and one Rateau wheel in the high-pressure part and five Rateau wheels in the low-pressure part is shown in fig. 3.

Mixed-pressure turbines are not generally connected electrically with the steam engines from which the supply of low-pressure steam is obtained, and must therefore be separately governed by a speed governor. In order to obtain satisfactory running in parallel with other engines, it is essential that the load of the turbo-set be independent of the steam conditions, which means that the speed of the turbine must be only dependent upon the load of the alternator, and independent of the low-pressure steam quantity available. The change in speed, when changing from high-pressure steam to low-pressure steam or *vice versa*, must therefore be as small as possible. These conditions were first realised by Prof. Rateau, who invented a governor fulfilling these conditions, which is now applied by nearly all the manufacturers of mixed-pressure turbines.

The present importance of the mixed-pressure turbine for this country is best illustrated by the fact that nearly 40 per cent. of the turbines ordered are of the mixed-pressure type.

In the case of low-pressure turbines the maximum outputs obtainable depend more on the turbine than the alternator, which is the reverse of the conditions obtaining in the case of high-pressure turbines.

Back-pressure turbines exhaust against a pressure above atmospheric pressure. Turbines which run non-condensing exhausting into free atmosphere are also included in this class.

The exhaust steam is generally used for heating purposes, as, for instance, in ships for heating the feed water or in mills for heating water in open pans, or in salt works for evaporating brine.

The governing of these turbines may differ according to the conditions prevailing. When all the steam is required for heating purposes, independent of the load, an ordinary speed governor is used, opening or closing a high-pressure throttle valve according to the load required. When, on the other hand, the turbine is required to work in parallel with other engines, and is intended to utilise only that amount of steam required for heating purposes, it need not be provided with a speed governor at all, the steam being controlled by the pressure in the heating steam pipe. If more heating steam is required, the pressure in the heating steam main decreases, and this change of pressure can be used to open the governor valve in a similar manner to that used for reducing valves.

Neither of the two methods is quite satisfactory in all cases. If, in the first case, more load is required than that obtainable from the heating steam available, steam must be passed through the turbine and blown into atmosphere. This represents a great loss, as this steam could be utilised in a low-pressure turbine. The second method is absolutely satisfactory in this respect, but it is necessary that the machine be run in parallel with other engines, the load of which is changed according to the heating steam quantity required.

An absolutely satisfactory arrangement can be obtained by the use of reducing turbines. In case the load of the turbine is more than that obtainable from the heating steam quantity required, the surplus steam is by-passed to low-pressure wheels, which are fixed on the same shaft and placed in the same cylinder.

The full-load consumptions and total efficiencies of the most important turbines are given in the following list:—

No.	Manufacturer.	Year of test.	KW.	Revs. per min.	Lb. per KW.-hour.	Total efficiency.
1	A.E.G.	1906	3,000	1,500	12·75	63·8
2	C. A. Parsons	1907	3,500	1,200	13·35	62·7
3	Westinghouse Machine Co.	1907	7,500	750	15·00	66·3
4	Brown-Boveri & Co. ...	1907	3,500	1,360	13·70	64·8
5	Escher, Wyss & Co. ...	1908	5,000	1,000	15·17	63·1
11	A.E.G.	1909	4,000	1,500	11·92	63·8
12	El. Maschinenfabrik ...	1910	3,500	1,500	14·07	64·8
14	Maschinenfabrik Augsberg Nürnberg	1910	2,500	1,500	15·50	64·5
18	B.T.H.	1911	3,000	1,500	15·96	64·7
21	Escher, Wyss	1910	4,000	1,000	13·30	64·4
22	Escher, Wyss	1910	2,000	3,000	13·03	66·0
25	Oerlikon	1911	3,000	1,500	11·62	64·1
26	British Westinghouse...	1911	3,000	1,500	13·72	63·9
27	British Westinghouse...	1911	5,000	1,500	13·00	67·9
28	Richardsons, Westgarth	1910	6,250	1,200	11·90	68·4

From this list it will be seen that the steam consumption has been improved from 12·75 lb. per KW.-hour in 1906 to 11·6 lb. per KW.-hour in 1911; and the total efficiency—

$$\frac{\text{Actual output of generator}}{\text{Mechanical equivalent of heat drop according to adiabatic expansion}}$$

from 63·8 per cent. in 1906 to 66·3 per cent. in 1907, and 68·4 per cent. in 1910. This figure has not been improved upon in 1911.

The best efficiency on mixed-pressure turbines running on low-pressure steam has been obtained on a 1,000-KW. turbine running at 3,000 R.P.M., made by the British Westinghouse Co. The efficiency realised in this case was 69·8 per cent.

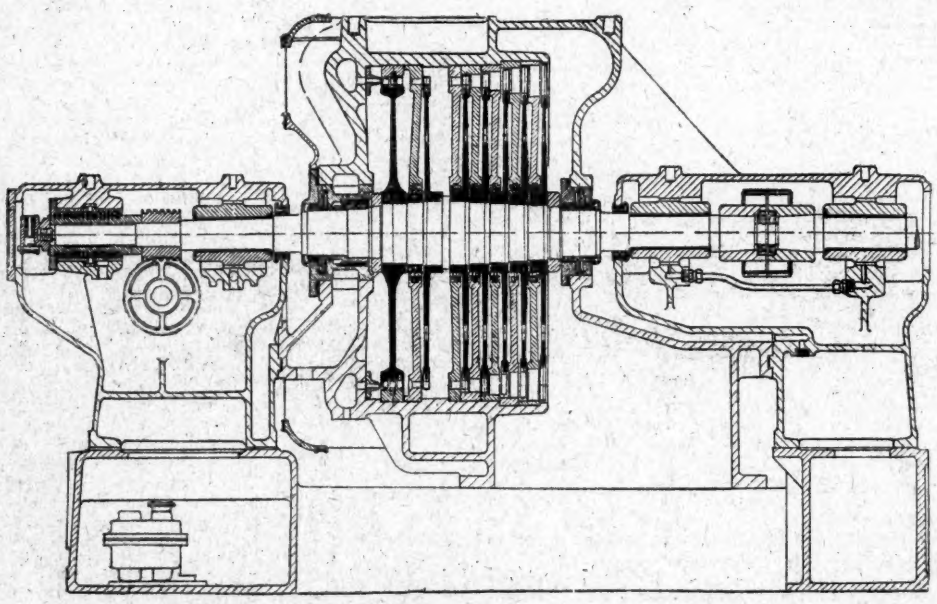


FIG. 3.—MIXED-PRESSURE TURBINE. THE BRITISH WESTINGHOUSE CO., 1910.

The efficiency of a steam turbine is the ratio:—

$$\frac{\text{Actual work done on turbine shaft}}{\text{Mechanical equivalent of heat drop according to adiabatic expansion}}$$

This ratio is referred to wherever efficiency is mentioned in the following discussion. In order to compare the merits of different steam turbines, the efficiencies as obtained above are usually calculated and compared. This, however, does not provide a rational basis of comparison, as the efficiency of a turbine is itself dependent upon the steam conditions. The author has adopted standard steam conditions to which the performances of all turbines can be reduced by applying proper corrections. These standard conditions are:—

For high-pressure turbines, 180 lb. per sq. in. pressure, 150° F. superheat, 28 in. vacuum (30 in. bar.).

For low-pressure turbines, 16 lb. per sq. in. absolute pressure, 0° F. superheat, 27½ in. vacuum (30 in. bar.).

According to our present knowledge the corrections to be made for superheat are independent of steam pressure and vacuum, and are therefore the same for high, low, and approximately for back-pressure turbines.

The corrections are as follows:—1 per cent. improvement of steam consumption of every 10° F. superheat. Between 0° and

100° F. superheat; for every 12° F. superheat between 100° and 200° F. superheat; and for every 14° F superheat between 200 and 300° F. superheat.

The efficiency increases with the superheat, and consequently the actual is larger than the theoretical correction, which is calculated from the variations of the available heat drop in adiabatic expansion.

The improvements in efficiency may be taken as 4·25 per cent better efficiency at 100° F. superheat, 6·75 per cent. at 200° F. superheat, and 7·5 per cent. at 300° F. superheat, than for dry saturated steam.

The corrections given have been deduced from a large number of tests made on impulse turbines; they are probably too large for pure Parsons turbines, which are unable to utilise high superheat to the same extent as impulse or impulse reaction turbines.

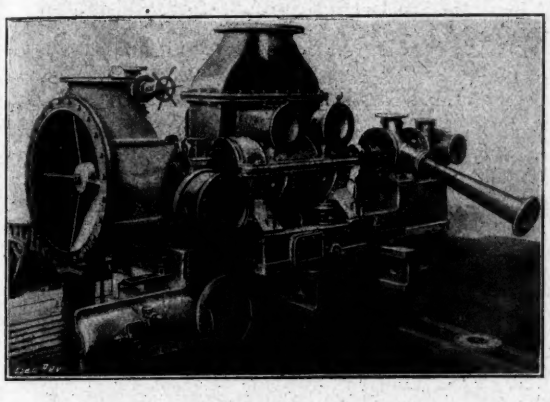


Fig. 4.—Westinghouse Turbine-Driven Auxiliary Pumps.

Tests have shown that when the steam is wet the efficiency is reduced. Assuming that the efficiency follows a continuous curve for superheated and wet steam when plotted with entropy as a basis, the efficiency will change by 1 per cent. for each 1 per cent. variation in wetness. It follows, therefore, that the steam consumption measured as condensed water will be 2 per. cent. higher for each 1 per cent. increase in moisture.

The efficiency of a turbine using and designed to use a very high vacuum will not be so good as that of a turbine of quite similar type, having the same number of stages, but designed to utilise a lower vacuum. The difference will be slightly larger for drum than for disk turbines, as the latter can be designed to use a higher vacuum to greater advantage than the former.

The average theoretical corrections obtained by considering the adiabatic heat drop available may be taken as 5 per cent. improvement of steam consumption for 1 in. between 26 and 27 in. vacuum; 6 per cent. between 27 and 28 in.; 7·75 per cent. between 28 and 28½ in.; and 11·5 per cent. between 28½ and 29 in. vacuum.

The actual improvement which can be obtained with the present design of impulse turbine is 4 per cent. between 26 and 27 in., 5 per cent. between 27 and 28 in. and 6 per cent. between 28 and 29 in. vacuum.

According to these figures the efficiencies of equivalent turbines with the same number of stages using and designed to utilise different vacua would be:—

1	per cent. better efficiency at	26	in. than at	27	in.
1	"	"	27	"	28 "
1	"	"	28	"	28½ "
2·5	"	"	28½	"	29 "

These figures represent a very fair average for any steam conditions between the limits of steam pressure, 100 lb. to 200 lb. per sq. in. gauge and superheat 0° F. to 300° F.

Whereas the superheat correction is nearly independent of the other steam conditions, the vacuum correction depends to a great extent upon the steam pressure, and is very much larger for low-pressure turbines. The average theoretical corrections for these are:—

12 per cent. improvement of steam consumption for 1 in. between 26 and 27 in.; 13·75 per cent. between 27 and 28 in.; 17 per cent. between 28 and 28½ in.; and 22·5 per cent. between 28½ and 29 in.

The actual improvements which can be obtained with the present design of low-pressure impulse turbine of similar construction, but increased number of stages for higher vacuum, are:—

11·5 per cent. improvement of steam consumption for 1 in. between 26 and 27-in. vacuum; 13 per cent. between 27 and 28 in.; and 14·5 per cent. between 28½ and 29-in. vacuum.

According to these figures, turbines using and designed to utilise different vacua give efficiencies as follows:—

0·5	per cent. better efficiency at	26	in. than at	27	in. vacuum
0·7	"	"	27	"	28 "
1·0	"	"	28	"	28½ "
3·5	"	"	28½	"	29 "

The corrections given represent a very fair average for any steam conditions between the limits: 14 lb. per sq. in. absolute, 0° F., and 18 lb., 100° F.

The efficiency which can be obtained with turbines having the same number of stages depends also, but in a lesser degree, upon the steam pressure. When the steam pressure is low not only are the leakage, ventilation and friction losses in the turbine smaller, but the blading efficiency increases as the total heat drop decreases.

The average theoretical corrections are as follows:—

2 per cent. improvement in steam consumption for 10 per cent. increase of pressure between 100 and 140 lb. per sq. in. gauge; 1·95 per cent. between 140 and 180 lb.; and 1·90 per cent. between 180 and 200 lb. per sq. in. gauge.

The actual improvement in steam consumption which can be obtained with the present design of impulse turbine is 1·5 per cent. for 10 per cent. increase of pressure between 100-200 lb. per sq. in. gauge.

According to these figures equivalent turbines having the same number of stages, using and designed to utilise different pressures, would give improved efficiencies as follows:—

0·4 per cent. better at 180 lb. per sq. in. than at 200 lb. per sq. in. gauge; 0·6 per cent. better at 140 lb. than at 180 lb.; and 1·9 per cent. better at 100 lb. than at 140 lb. per sq. in. gauge.

These corrections are a very fair average for any steam conditions between 0° F. superheat, 26-in. vacuum, and 300° F. and 29-in. vacuum.

The range of pressure met with in low-pressure turbines is so small that the pressure correction for thermo-dynamic efficiency is negligible. The average consumption correction is 4 per cent. improvement for 10 per cent. increase of pressure between 14 and 18 lb.

These figures may be taken as a fair average between the limiting steam conditions, 0° F. superheat, 26-in. vacuum, and 100° F. superheat, 29-in. vacuum.

The corrections we have already considered refer to the steam consumptions of turbines utilising steam conditions for which they have been specially designed, and are of the greatest importance to the purchaser when fixing the steam conditions under which turbines have to work.

The most economical speed for small low-lift pumps and high-lift pumps is too high for reciprocating engines, and it was therefore necessary to drive these either by belt, gearing, or by means of electric motors. The advent of the steam turbine, however, made direct coupling possible, but it necessitated the further development in these pumps so that the speed might be sufficiently high to enable a reasonably efficient turbine to be built at a competitive price.

The advantages of steam-driven pumps are often of great importance in the case of pumps used for condensing plants. A view of such a group for a surface condenser is given in fig. 4, which shows a turbine on a overhung shaft driving a centrifugal

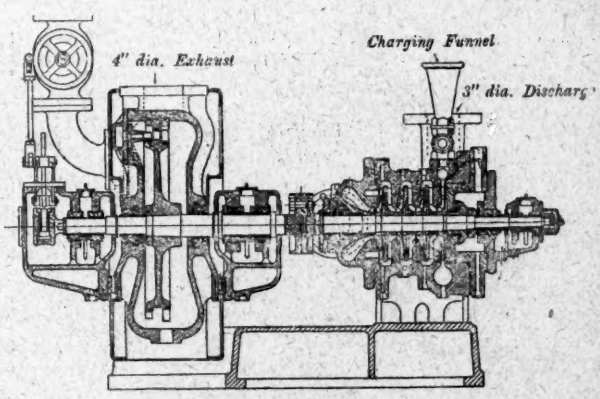


Fig. 5.—Turbine-Driven Boiler Feed Pumps.

pump with two double-flow impellers of the helico-centrifugal type, a rotary air pump of the Le Blanc type, and an extraction pump consisting of one double-flow impeller.

This set, which is running at 2,500 R.P.M., is used in conjunction with a 3,000-KW. mixed-pressure turbine for a full-load steam quantity of 80,000 lb. per hour.

A section of a horizontal turbine driving a boiler feed pump running at 4,000 R.P.M. is shown in fig. 5.

Association of Mining Electrical Engineers.

A meeting of the East of Scotland Branch was held at Edinburgh on Saturday last, when an interesting paper was read by Mr. R. H. Willis, British Electrical Plant Co., Alloa, on "The Mechanical Design of Electrical Plant usually found in Collieries." He said that all electrical plant which was to be used in collieries should be characterised by extreme robustness. Undoubtedly it would pay in the long run to install a machine with the heaviest shaft, longest bearings and stiffest brush gear. This was particularly the case with regard to three-phase machines where, of necessity, clearances between the rotor and the stator were small, and consequently no undue deflection could be allowed on the shaft. In such a case, also, the length of the bearings was of importance. Two methods were adopted to get over the trouble in fairly large machines. The first was to mount the rotor in bearings inde-

pendent of the end frame, and these bearings could then be packed to compensate for any wear that might take place. The second arrangement was to have adjusting screws in the end frames so that the latter could be raised and lowered in relation to the stator as might be required. Oil flinging was one of the most most fruitful sources of trouble in connection with electrical machinery. It was difficult to account for this, as frequently he had seen two machines identically alike, made from similar stock parts, and running at the same speed, the one throwing oil badly and the other perfectly dry. All the same, the general lines to be adopted to prevent this trouble comprised a large oil flinger of either one or two ridges, with a capacious bell mouth coming well down to the shaft, and with large overthrow drains to permit the oil to run back into the oil well. In cases where machines were provided with fans it would be often found, in spite of the above precautions, that the oil was sucked out of the bearing by the fan. In this case it became necessary to provide an additional cap over the bell mouth, absolutely closing it.

NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

Mazda Traction Lamps.

The strength of the Mazda drawn-wire lamp has greatly extended its field of use; it has been demonstrated that it can be operated satisfactorily even under the severe service conditions on battleships under target fire, and the fact that these lamps are suitable for use on electric tramways instead of the ordinary carbon lamps has been verified by tests on the part of a number of leading tramway companies, who have found them give satisfactory results. The BRITISH THOMSON-HOUSTON CO., LTD., of Mazda House, E.C., have therefore standardised a line of Mazda traction lamps, which are supplied in a nominal rating of 30-C.P. 35-watt, and 30-C.P. 40-watt, all rated at an efficiency to give a length of life that is economical for the conditions of tramway power costs. These lamps

FIG. 1.—MAZDA TRACTION LAMP.

are supplied for series burning, so as to operate in the standard arrangement of five lamps in series for railway voltages of 500-volt, 550-volt or 600-volt. The marked improvements in energy consumption amounting to about 70 per cent., render these traction lamps an economical substitute for the old type of lamp.

Bosch Force Feed Lubricator.

This is a new form of mechanically driven oil pump for force feed lubrication, and is adaptable to all kinds of high and low-speed engines, machine tools, &c. The action of the lubricator is positive, and the oil which is forced into the tube by the pump must, under all circumstances, reach the point where the lubrication is required. A separate set of pumps is provided for each oil supply. Each arrangement consists of a pump body, valve and pumping piston, the suction and pressure actions for each section being permanently connected with the pump body. It works equally well in either direction of rotation, and can be arranged for rotary drive or oscillatory drive as desired. The pumps are driven by a worm drive, which is transmitted direct without any other gearing; all the pumps are mounted to a common centre, and are brought successively into operation by means of two small inclined disks mounted on a vertical shaft, one disk operating the valves and the other the pump plungers. The various feeds can easily be adjusted, and the whole pump body can be removed completely from the tank for inspection or replacement by removing a few screws.

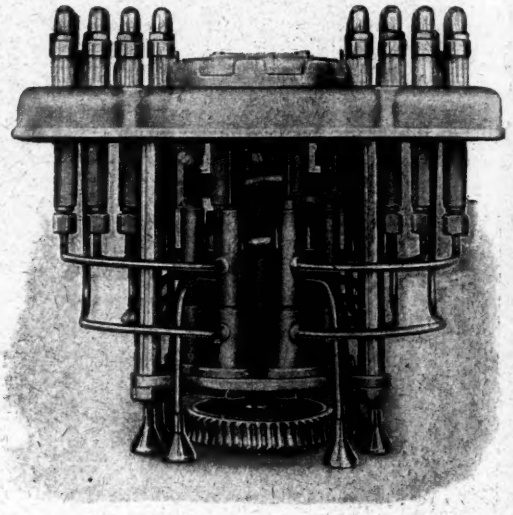


FIG. 2.—BOSCH FORCE FEED LUBRICATOR.

There are no springs and no intricate mechanism in this type of lubricator, which is substantially made, so that there is no likelihood of its getting out of order. All adjustments are made from the outside of the tank. The oil feed is absolutely positive, and the lubrication is, of course, in proportion to the speed with which the lubricator is driven.

The accompanying illustration shows the pump body removed from the tank; the separate strainers, pumps, disks, sight feeds, &c., can readily be seen. The pump is made by the BOSCH MAGNETO CO., LTD., 40, Newman Street, W.

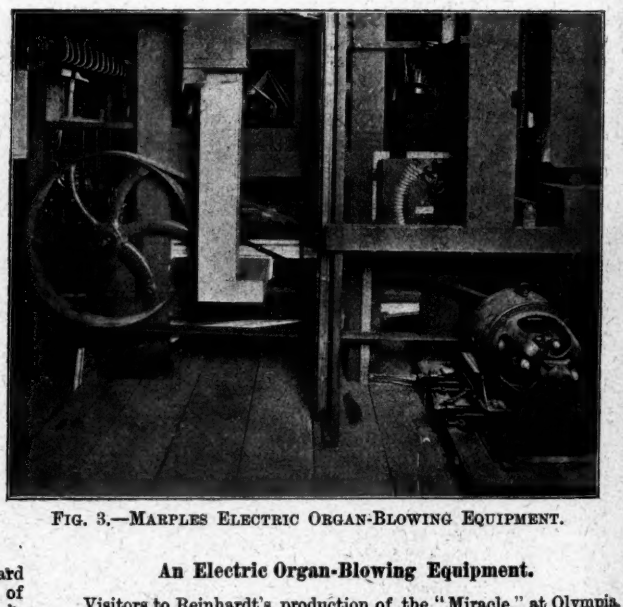


FIG. 3.—MARPLES ELECTRIC ORGAN-BLOWING EQUIPMENT.

An Electric Organ-Blowing Equipment.

Visitors to Reinhardt's production of the "Miracle," at Olympia, will have been impressed by the effective organ, which has been erected by the well-known organ builders, Messrs. Brindley and Foster, of Sheffield and London, and it is interesting to note that the instrument is provided with an electric organ-blowing equipment, controlled by the Marples patent regulator. As will be seen in fig 3, this consists of a low-speed D.C. motor, running at approximately 200 R.P.M., connected by means of a belt to a 36-in. diameter pulley on a three-throw crankshaft, which, in turn, drives three wedge-shaped feeders.

The motor is mounted practically within the organ case, and is absolutely silent in working. The speed of the motor is regulated by means of the radial multiple-contact starting and regulating device shown in the illustration. The arm is connected by means of a chain to the top of the main reservoir, and is so arranged that when the reservoir is full the motor automatically stops. As the wind is used the motor will increase its speed or slow-up automatically, always keeping the bellows full.

The Marples patent regulator provides not only the regulating

stops, but also a sufficient number of starting stops, so that an additional motor-starter is not required. The only apparatus which the organist has to operate is a single-pole switch placed in a convenient position at the keyboard. This type of controller has been fitted already in over one hundred churches, public halls, &c., and is supplied by the Adnil Electric Co., Ltd., Artillery Lane, London, E.C.

Simplex Hand Lamp.

In addition to the question of a substantial hand lamp which complies with the various requirements laid down by the Home Office for use in factories, there is a large demand for a type which prevents unauthorised removal of the electric lamp itself from the handle carrying it. As is well known, the Home Office Regulations have been laid down with a view to preventing the user of the lamp from receiving a shock which might prove dangerous, and which has been known to be fatal. Both these objects are effected in a new form of hand lamp now being put upon the market by Simplex Conduits, Ltd., of Garrison Lane, Birmingham, and illustrated in section in fig. 4. It is of substantial construction, with a handle made of insulating material. The lamp-locking device is arrived at by means of a screwed bush *b*, into which the

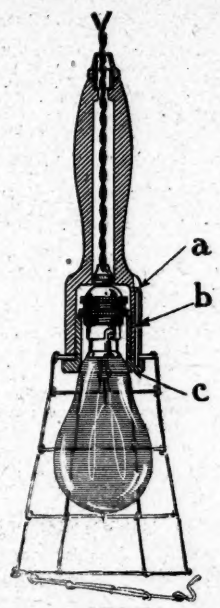


Fig. 4.—Section of Simplex Hand Lamp.

lamp and an ordinary shade carrier and cord grip-holder are fitted in the manner shown. When the shade ring is screwed down tightly on to the upper end of the bush, obviously the lamp will be locked; the whole is then screwed into the handle of the lamp. To take up any uneven expansion and contraction due to heating, an asbestos washer is fitted round the screwed bush at *c*; the bush and the handle of the lamp are locked by means of a pin inserted in a slot at *a*, so arranged that the pin itself can be sealed when once in position, and therefore rendered safe from interference on the part of any unauthorised person. The whole arrangement is simple and effective, and is well calculated to prevent thieving.

The "Glareguard."

For very many purposes a strong local illumination is necessary, and is best obtained by lowering a pendant or bracket electric lamp to a distance of a couple of feet above the work in hand; but this

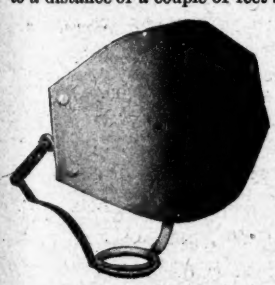


Fig. 5.—The "Glareguard."

Fig. 6.—"Glareguard" in Use.

has the very objectionable result that the user's eyes are then subjected to the glare of the lamp, and it is a very common thing for a strip of paper to be stuck on the edge of the shade to shield the eyes, giving a very untidy effect. To remedy this drawback, the General Electric Co., Ltd., of 67, Queen Victoria Street, E.C., have introduced a neat little device called the "Glareguard" (fig. 5), which can be used with any existing shade or fitting; it consists simply of a cardboard shield, green outside and white inside, attached by a jointed brass frame to a collar which is fixed on the lampholder with the aid of the shade-carrier, as shown in fig. 6. It is readily adjustable to the most comfortable position, and should prove a most popular and beneficial device.

"Slipon" Shade Carrier.

An extremely neat solution of the problem of fixing shades on lampholders has been arrived at by Messrs. Jackson Brothers, of 37A, Woodgrange Road, Forest Gate, London, E. It consists simply of a brass ring with spring claws, which is pushed on the barrel of the holder after the shade has been put in place. The ring and its application are illustrated in figs. 7 and 8. It might be thought at first sight that the fastening would be insecure; this, however, is quite a mistake. When the barrel is screwed for the nut usually employed (which is, of course, dispensed with in this case), the claws grip the thread so firmly that quite a vigorous pull is required to remove the ring, a fact which we have personally verified; and even where the barrel is not threaded, the frictional grip is said to be ample to sustain the shade. But, in addition to this, another safeguard is provided, for when a lamp is in the holder, the pins of the bayonet socket project through the slots sufficiently far to render it impossible for the ring to be removed. Thus the device is suitable for use even where there is considerable vibration, as, for

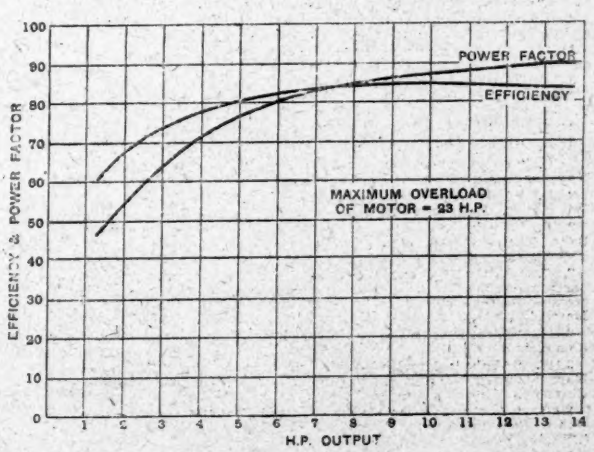
Fig. 7.—"Slipon" Shade Carrier.

Fig. 8.—Mode of Using the "Slipon" Carrier.

instance, on tramcars. The difficulty of removing the ordinary screwed ring is familiar to all users, and has been intensified in the case of the deep shades used with metallic-filament lamps; with the "Slipon" carrier it suffices to pull the shade off, without putting the band or a special tool inside it at all. The claws can readily be adjusted to suit slight variations in the diameter of the barrel. The cleaning of shades and reflectors is often neglected on account of the bother of unscrewing the nut and replacing it; but this invention, which can be applied to holders already installed, renders it an easy matter to carry out this operation, the importance of which ought to be more generally realised.

TESTS OF A NEW A.C. MOTOR.

It will be generally agreed that while the strenuous competition in electrical machinery has caused designers to go most carefully into the various factors of design, with the result that a far more effective use is now made of material than was the case ten



years ago, there is at the same time an uneasy feeling that electrical machinery is occasionally over-rated.

Moreover, in A.C. motors, which are frequently sold to people who have no means of testing them, or even any appreciation of the results of tests, there are great possibilities of reducing the qualities of the machine without any risk of detection.

We do not think for a moment that this course is followed by manufacturers of repute, but at the same time it rather suggests that the small power user should exercise some caution when putting in alternating-current motors. And he should realise that he must pay a reasonable price in order to obtain a machine which will give him satisfaction.

We are not referring so much to the risk of mechanical breakdown, because that in these days is quite rare. What we have in mind is the small losses, which, while in a small motor almost negligible, are likely to mount up to a very considerable sum in the case of a number of motors in operation for some hours per day.

It is satisfactory to know that there are quite excellent designs of small A.C. motors on the market, which are not only mechanically sound, but also give very excellent results from an efficiency point of view.

We give herewith the results of an independent test made on one of the A.C. motors which have been put on the market by Messrs. Scholey & Co., Ltd.; the figures, both from the point of view of temperature and efficiency, are remarkably good.

The curves attached also show quite a good power factor and efficiency, demonstrating that the motor has been very carefully designed.

The following are tests on a Scholey-Ingleby 10-H.P. induction motor, squirrel-cage, 1,500 revolutions, 400 volts, 50 cycles, three-phase :—

	Revs.	Volts.	Current per phase.
No load	1,500	400	4·3 amperes.
Full load ...	1,415	400	14·5 ,,
25 % overload ...	1,400	400	18 ,,

Temperature rise after six hours' run :—

Stator windings	40·5° F.
Stator core	32·5° F.
Rotor core	30·6° F.

Pull-out load, 23 H.P. at normal volts.

NEW PATENTS APPLIED FOR, 1912.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs. W. P. Thompson & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

2,896. "Electrical switches." A. Crawford. February 5th.

2,902. "Hygienic attachment or cover for telephone mouthpieces." F. M. Stanton. February 5th.

2,910. "Electrically-operated boat hoists." J. Fielding. February 5th.

2,914. "Receiver hook-lock for telephones." P. Le Breton. February 5th.

2,936. "Insulator for supporting the current rails of electric railways." A. Watkins. February 5th.

2,964. "Accumulators or secondary batteries." W. K.-L. Dickson. February 5th. (Complete.)

2,957. "Electric railway systems." K. E. Stuart. February 5th.

2,979. "Electric boat hoisting apparatus." J. Fielding. February 6th. (Complete.)

3,007. "Means for governing the speed of alternating-current commutator machines." H. C. E. Jacoby. February 6th. Addition to 20,495/1907.)

3,011. "Electric hand-lamps." H. Lucas and W. H. Edwards. February 6th.

3,023. "Manufacture of metal-filaments for electric lamps." T. Terrell and W. L. Pakenham. February 6th.

3,026. "Water-tight binding post for electric cables." Firm of R. Bosch. (Convention date February 20th, 1911, Germany.) February 6th. (Complete.)

3,046. "Construction of appliance for disinfecting telephone mouthpieces." A. Weintraud. February 6th.

3,054. "Magnifying and detecting weak alternating currents." Marconi's Wireless Telegraph Co., Ltd., and H. J. Round. February 6th.

3,055. "Wireless telegraph receiving apparatus." Marconi's Wireless Telegraph Co., Ltd., and J. H. Round. February 6th.

3,061. "Means for attaching dynamo electric machines adapted to be driven by velocipede wheels and the like." C. Schlick. February 6th. (Complete.)

3,065. "Electric arc lamps of the type in which carbons impregnated with chemicals are consumed in a chamber substantially air-tight." B. A. Quint. February 7th.

3,082. "Self-indicating fuse cut-out for electrical distribution fuseboards." E. Walters. February 7th.

3,097. "Telephone systems." E. R. Corwin. February 7th. (Complete.)

3,098. "Telephone systems." E. R. Corwin. February 7th. (Complete.)

3,099. "Incandescence electric lamps." A. W. Beuttell and J. A. Manners-Smith. February 7th.

3,105. "Automatic dynamo-electric machines." H. F. Foster and A. W. S. Poclington. February 7th.

3,106. "Cooling arrangements for dynamo-electric machinery." Siemens Bros. Dynamo Works, Ltd. (Siemens-Schuckertwerke G.m.b.H., Germany.) February 7th. (Complete.)

3,107. "Method of connections for eliminating the influence of the temperature on the current strength of a resistance, the magnitude of which increases with the temperature." Fried. Krupp Akt.-Ges. (Convention date, March 4th, 1911, Germany.) January 7th. (Complete.)

3,114. "Electric warp stop-motions for looms." D. Schatz. February 7th, (Complete.)

3,117. "Method of multiple-control for electric motors." R. Richter and Maffei-Schwartz-Koffp Werke G.m.b.H. (Convention date, April 21st, 1911, Germany.) February 7th. (Complete.)

3,121. "Safety fuses for electrical installations." Appareillage Gardy (S.A.) (Convention date, February 23rd, 1911, Switzerland.) February 7th. (Complete.)

3,128. "Electrical railways having automatic traction systems." J. J. Deschamps. (Addition to 2,825/1912. Convention date, June 30th, 1911, United States.) February 7th. (Complete.)

3,144. "Electric lifts of the alternating-current type and the like." H. J. Morsey. February 7th.

3,146. "Trolley head for overhead electric traction cars." W. Wood. February 7th.

3,166. "Means of increasing the E.M.F. of rotary converters for battery charging and the like." A. M. Taylor. February 8th.

3,235. "Automatic telephone toll-recording systems." H. W. Fitchett. February 8th.

3,236. "Electrically-driven clocks." P. A. Bentley. February 8th. (Complete.)

3,244. "Process for the manufacture, isolation and enrichment of radium and other radio-active substances." E. Ebler. (Addition to 2,155, 1912. Convention date, November 21st, 1911, Germany.) February 8th. (Complete.)

3,249. "Arrangement for electric machines to reduce the circulating currents in the coils under commutation." P. L. R. Fraser. February 9th.

3,253. "Electric heating element." H. J. Dowsing and D. Huntley. February 9th.

3,263. "Electric cable conductors for the conveyance of variable currents applicable to telephonic or other purposes." W. E. Hitch. February 9th.

3,264. "Metal-filament lamp preserver." W. W. Garby. February 9th.

3,269. "Arc lamp." Korting & Mathiesen Akt.-Ges. (Convention date, December 2nd, 1911, Germany.) February 9th. (Complete.)

3,281. "Driving vehicles by means of internal combustion engines combined for recuperating purposes with dynamos, accumulator batteries and motors." H. Pieper. (Convention date, February 20th, 1911, Germany.) February 9th. (Complete.)

3,322. "Electric heating elements particularly applicable to electric cooking apparatus." H. H. Holmes and W. A. Street. February 9th.

3,325. "Electrical resistance bodies and the manufacture thereof." G. Cooper. February 9th.

3,334. "Transmitters and receivers for wireless telegraphic and telephonic apparatus." E. Bellini. (Addition to 11,389, 1911.) February 9th. (Complete.)

3,335. "Means for holding electrical insulators." Bullers, Ltd., and G. V. Twiss. February 9th. (Complete.)

3,338. "Electric fused switches and switchboards." H. H. Berry and W. J. Markham. February 9th.

3,341. "Electrodes for electric arcs." A. J. Boult. (Dynamit Akt.-Ges. vorm. Alfred Nobel & Co., Germany.) February 9th. (Complete.)

3,342. "Process and apparatus for carrying out gas reactions in the electric arc." A. J. Boult. (Dynamit Akt.-Ges. vorm. Alfred Nobel & Co., Germany.) February 9th.

3,348. "Incandescent electric lamps." R. H. Singley. February 9th. (Complete.)

3,366. "Process for electro-plating non-conducting articles." A. Frei. February 10th. (Complete.)

3,397. "Electric arc lamps." Crompton & Co., Ltd., and C. Crompton. February 10th.

3,381. "Electric means or apparatus for setting of one or more alarums from one clock for use in one or more sleeping or other apartments." J. F. X. Miller. February 10th.

3,412. "Electricity meters." S. Z. de Ferranti. February 10th. (Complete.)

3,419. "Electric automatic alarm for notifying the approach of a train." T. H. Harvey. February 10th.

3,481. "Stands, wall brackets and the like for electric lamp and other electric fittings." Callender's Cable and Construction Co., Ltd., A. R. Kibblewhite and H. Hill. February 10th. (Complete.)

3,492. "Supports for electric arc lamps." Jandus Arc Lamp and Electric Co., Ltd., and A. D. Jones. February 10th.

PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of Messrs. W. P. Thompson & Co., 285, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 9d. (in stamps).

1910.

Telephonic Apparatus. E. A. Graham. 23,742. October 18th.

Electrical Condensers. British Insulated and Helsby Cables, Ltd., and A. E. Bayles. 24,084. October 18th.

Electric Wires or Cables. British Insulated and Helsby Cables, Ltd., and E. A. Bayles. 26,591. November 16th.

Fusible Cut-Outs for Controlling Electric Circuits. V. Hope. 29,122. December 15th.

1911.

Moulds Suitable for use in the Manufacture of Electric Accumulator Electrodes. R. Pape. 905. January 12th. (Cognate application, No. 12,019 of 1911.)

Transmission of Sound by Electrical Means. S. G. Brown. 956. January 12th.

Process for Obtaining Rapidly the Establishment or the Variation of the Electromotive Force of a Dynamo-Electric Machine. Soc. Alsacienne de Construction Mecaniques. 1,252. January 17th. (January 17th, 1910.)

Controlling Apparatus for Electrical Lifts. A. W. Penrose & Co. and F. Barlow. 1,385. January 18th.

Electric Welding. F. B. Koopman and Pontelec Welding Patents, Ltd. 1,563. January 20th.

Electric Signalling on Railways. H. Brown. 1,536. January 20th.

Electrically-Heated Cooking Apparatus. W. P. Perry. 1,883. January 25th.

Electrically-Heated Ovens. W. P. Perry. 1,885. January 25th.

Rheostat Adapted to be Regulated from a Distance. L. C. Eilersten. 8,156. March 1st. (March 31st, 1910.)

Electric Switches, Circuiting Breakers and the like. P. K. Morris and G. A. Lister. 8,905. April 1st.

Electric Motor-Generators. Electric and Ordnance Accessories Co. and H. V. Bowen. 9,856. April 24th.

Automatic Disinfecting Device for Telephones. P. Z. Andronikoff. 10,116. April 26th.

Electric Meters of the Electrolytic Types. C. F. Mounsdon. 10,689. May 3rd.

Magneto-Electric Machines. H. C. H. Smith. 12,011. May 18th.

Primary Galvanic Batteries. R. Darby. 14,769. June 24th.

Plate-Carriers for Stereoscopic X-Ray Photography. S. Kelly. 17,122. July 26th. (August 1st, 1910.)

Treating Substances by Electro-Osmosis. Felten & Guilleaume Carlswerk Akt.-Ges. 17,597. August 2nd. (August 2nd, 1910.)

Indicating Tail-Lamp. M. S. Rosenfeld. 18,447. August 15th. (August 26th, 1910.)

Electric Contact-Breakers. F. Belfitt. 18,478. August 16th.

Electric Signal Apparatus. W. S. Reynolds. 18,698. August 19th. (March 17th, 1911.)

Driving Gear of Electrically-Operated Winches. D. Wilson. 18,911. August 23rd.

Circuit Arrangements for Automatic Telephone Systems. Siemens and Halske Akt.-Ges. 19,186 and 19,231. August 27th. (August 27th, 1910.)